The History of
PHOTOGRAPHY

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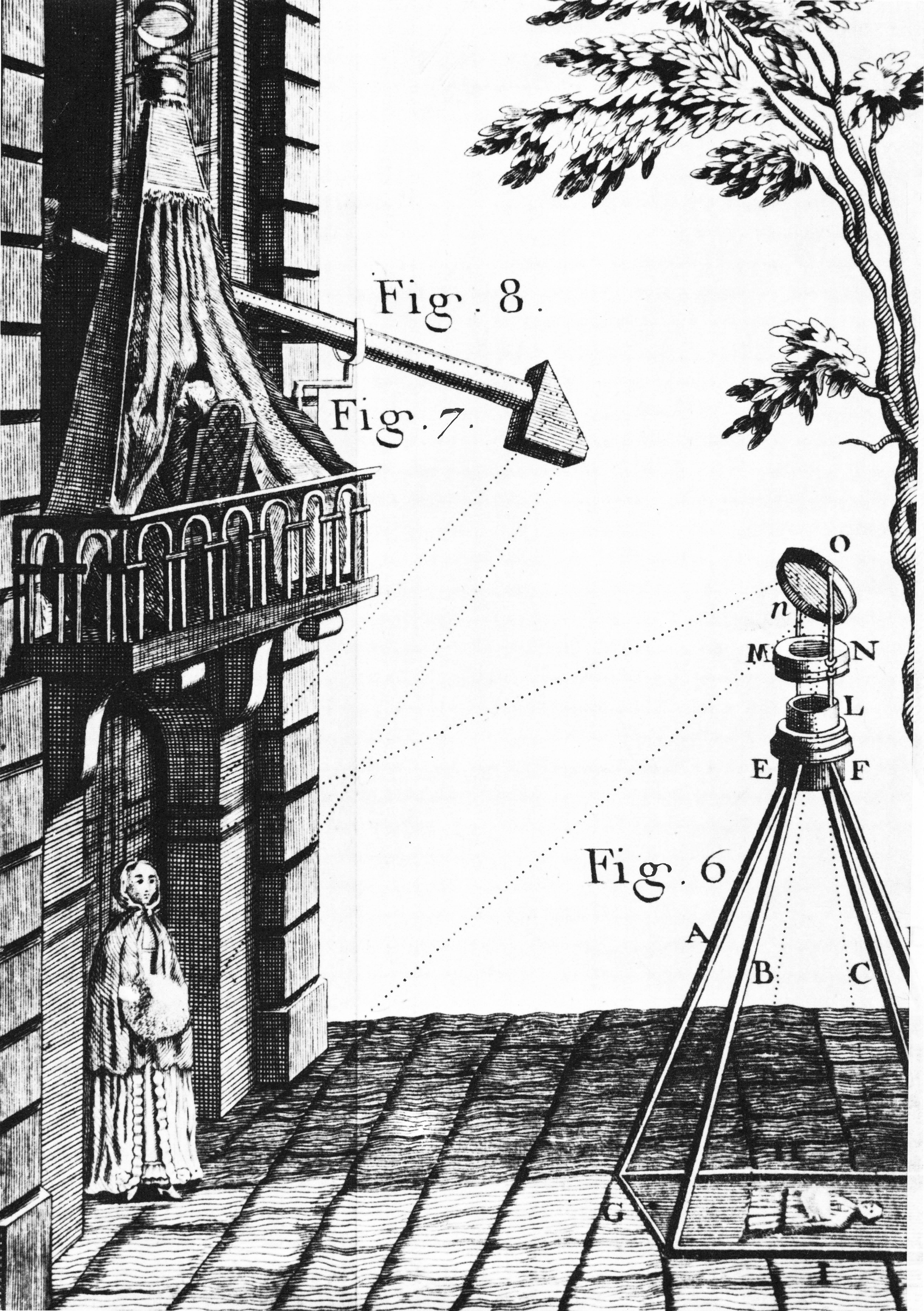
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The History of PHOTOGRAPHY

from the camera obscura to the beginning of the modern era

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Illustrations reproduced in Germany by Klischeewerkstätten der Industriedienst, Wiesbaden

Printed in Switzerland by Imprimeries Réunies S.A., Lausanne

Bound in Holland by Van Rijmenam N.V., The Hague

500 01060 9

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Foreword

'PHOTOGRAPHY would be a most interesting subject, were it not for the pictures' was the opinion of a prominent scientist a century ago. This paradoxical pronouncement shocked the majority of photographers, whose main interest was rightly the production of *pictures*, leaving the investigation of chemical and optical phenomena to scientists. Photography is, of course, both an art and a science, and since the camera is fundamental to its existence, the ingredients of a history of photography are laid down beforehand and only their relative proportions can be varied according to the historian's training and inclinations.

Since 1839 photography has gradually conditioned the world to its image-making – to such an extent that today it is responsible for an estimated 97 per cent. of our visual information. Its ever-increasing importance as a means of communication, and its consequent contribution to our cultural life, must inevitably predominate over technical and scientific aspects which are subservient to the medium, though some previous historians paid only scant attention to photography's role as picture producer. Due prominence must also be given to photography's far-reaching social consequences: it first made possible portraiture for the million, it opened up new fields of employment for women, and in the dissemination of knowledge it proved to be the most valuable invention since that of the printing press.

The first edition of *The History of Photography*, published in 1955 by the Oxford University Press, immediately established itself as a standard work. The publication of this second edition has made it possible to introduce ten additional chapters and much other information that had formerly to be omitted in order to keep the book within a strictly prescribed length. The new material, which will greatly enhance the value of this history as a reference work, includes chapters on the daguerreotype period in France, America and the German-speaking countries; early news photography and documentation; landscape and architectural photography in India, the Far East and America – in addition to the former coverage of Europe and the Near East. The aesthetic movement at the *fin de siècle*, which spread from England across Europe and to America, is dealt with in much greater detail. Since much present-day photography is in colour (a trend which developed rapidly in the mid-1950s) it also became desirable to include a chapter on the evolution of colour photography.

The technical side, too, has been expanded by the inclusion of sections on shutters and exposure meters, while some of the more important applications of photography – aerial, under-water, in criminology, and X-rays – have also found their place in the revised edition.

Many of the existing chapters have been remodelled and enlarged by the incorporation of new information, and the illustrations have been extensively revised and expanded.

This book, based on twenty years of research by the authors, deals exhaustively with the evolution of photography as an art and technique and its leading personalities from its optical and chemical pre-history to the First World War. To deal with the period since 1914 would require a second volume. For those interested in the later period and in other works on the science and art of photography, biographies of individual photographers etc., an extensive bibliography and *c.* 800 footnotes giving detailed references have been included.

Helmut and Alison Gernsheim. Castagnola, 1969

Introduction

THE INTRODUCTION OF PHOTOGRAPHY dates from January 1839 when both Daguerre's and Talbot's inventions were officially announced, but photographs in the established meaning of the word–permanently fixed images of the camera–had already been taken by Niépce in 1826, by Talbot in 1835 and by Daguerre in 1837.

During the last decade of the eighteenth century it occurred to Nicéphore Niépce and his brother Claude in France, and to Thomas Wedgwood in England, to try to produce pictures without manual intervention. In order to arrive at a fuller understanding of the evolution of photography, however, we need to go back much farther than Niépce and Wedgwood and examine the work of a large number of experimenters who, according to their field of research, were working either on the optical or on the chemical components of photography.

The camera obscura was known to the Arabian scholar Ibn Al-Haitham (Alhazen) before 1038; spectacle lenses are mentioned by Roger Bacon and seem to have been well known by the end of the thirteenth century; the darkening of nitrate of silver on exposure to sunlight was first recorded by Angelo Sala in 1614. But whereas the camera obscura served at first simply as a convenient means of observing solar eclipses, and, from the Renaissance on, as an aid to drawing, it was not until 1550 that a lens was fixed to the instrument by Girolamo Cardano, and the fact that the darkening of silver salts by light can be applied to the making of images was only discovered by Johann Heinrich Schulze in 1725. Considering that knowledge of the chemical as well as the optical principles of photography was fairly widespread following Schulze's experiment–which found its way not only into serious scientific treatises but also into popular books of amusing parlour tricks–the circumstance that photography was not invented earlier remains the greatest mystery in its history.

Wedgwood was the first to unite the two strands spun by earlier investigators which form the raw material of photography–the darkening of silver salts in light, and the image of the camera obscura–but it was left to Niépce, Daguerre, Talbot and others to begin weaving the complex pattern of the new art which illustrates our modern civilization in all its phases. It had apparently never occurred to any of the multitude of artists of the seventeenth and eighteenth centuries who were in the habit of using the camera obscura to try to fix its image permanently, and it was only when scientific men like the above-mentioned wanted to make pictures and turned to the camera obscura for assistance, that optics and chemistry were at last combined in photography. Of its inventors, only Daguerre was a professional artist–and *his* skill was exclusively directed to the production of astonishingly successful *trompe-l'oeil* effects, for which he naturally found the camera obscura indispensable. His lack of scientific knowledge was later counterbalanced by the attainments of his partner Nicéphore Niépce, and by sheer perseverance in experimentation.

The invention of photography is the result of an evolution rather than a sudden discovery by any one man. Given knowledge of the same principles, it is only to be expected that men working quite separately and without knowledge of each other should make the same invention at about the same time, and this is borne out by the numerous different processes for which claims of priority were made in various parts of Europe immediately after Arago had fired the opening shot, so to speak, by announcing Daguerre's discovery on 7 January 1839.

The invention of photography has been variously ascribed to Thomas Wedgwood, who conceived the original idea but was unsuccessful in practice; to Nicéphore Niépce, who first succeeded in taking a permanent photograph from nature; to Daguerre, who invented the first practicable process of photography; and to Fox Talbot, who introduced the negative/positive process, the principle still employed in photography today. In our opinion, Niépce alone deserves to be considered the true inventor of photography–a fact confirmed by our rediscovery of the world's first photograph which led us to a re-assessment of his pioneer work.

The contemporary photographs in this book have been reproduced from copies of original prints; no retouching has been used to eliminate blemishes arising from early techniques or age.

Part I

THE PREHISTORY OF PHOTOGRAPHY

1 *The history of the camera obscura*

ROOM FORM, OR CAMERA OBSCURA IMMOBILIS

The photographic camera derives directly from the camera obscura which was originally, as its name implies, literally a dark room, with a tiny hole in the roof, wall, or window-shutter through which the view outside was projected on to the opposite wall or a white screen opposite the hole. Its invention has been erroneously ascribed by various writers to Roger Bacon, Alberti, Leonardo da Vinci, and G. B. della Porta, but in fact it was described 250 years before Bacon, by the tenth-century Arabian scholar Hassan ibn Hassan called Ibn Al-Haitham, generally known by the medieval Latin version of his name, ALHAZEN. The optical principle of the camera obscura images was known to Aristotle (384–322 B.C.) who observed the crescent shape of the partially eclipsed sun projected on the ground through the holes of a strainer, and the gaps between the leaves of a plane tree. He also noticed that the smaller the hole, the sharper the image. Knowledge of the camera obscura was in all probability fairly widespread among Arab scholars, for Alhazen's account does not in any way imply that he divulges a novel observation. It will be seen from the following passage that Alhazen stressed the significance of the relationships between size of aperture and sharpness of image, which in photographic cameras is regulated by a diaphragm.

> If the image of the sun at the time of an eclipse–provided it is not a total one–passes through a small round hole on to a plane surface opposite, it will be crescent-shaped. . . . The image of the sun only shows this property when the hole is very small. If the hole is larger the image changes, and the change is more marked with increasing size of the hole. If the hole is very large, the crescent shape of the image disappears altogether, and the light [on the wall] becomes round if the hole is round, quadrangular if it is quadrangular, and with any shaped opening you like, the image takes the same shape, always provided the hole is large and the receiving surface parallel to it.

This passage occurs in an Arabian manuscript in the India Office Library, London, but though attention was drawn to it in 1910,[1] later historians missed or ignored it.

ROGER BACON was well acquainted with Alhazen's works, and passages in his *Perspectiva* and *De multiplicatione specierum* (both *c.* 1267) seem to indicate that he knew the principle of the camera obscura, and, moreover, for observing not only eclipses but also the view outside the darkened room.

> Mirrors may be so arranged that we may see whatever we desire and anything in the house or in the street, and everyone looking at those things will see them as if

> they were real, but when they go to the spot they will find nothing. For the mirrors are concealed [from the viewer] and so placed with respect to the objects, that the images are in the open and appear in the air at the junction of the visual rays with the perpendicular plane [*cathetis*]; therefore those looking will run to the image, and think that things appear there when there is nothing, but merely an apparition.[2]

It is debatable whether this account refers to images of the camera obscura or to a method of projection by mirrors, especially since Bacon does not mention a small hole in the window-shutter. But we are inclined to think that Bacon–like some later writers–may well have taken knowledge of the camera obscura's elementary principle for granted, and only described the *improvement* by means of mirrors, which is not mentioned again until the sixteenth century. There can be no doubt that he was acquainted with it, whatever the detractors of the above reference may say, for he did illustrate the principle of the sun's rays passing through an aperture and projecting an image of the sun's disk on a wall, in his treatise *De multiplicatione specierum*.

Moreover, JOHN PECKHAM, Archbishop of Canterbury, Bacon's contemporary and believed to have been his pupil, dealt with the same phenomenon in *Perspectiva communis* (1279) and noted its application to the observation of eclipses. He said, 'When at the time of an eclipse of the sun, its rays are received in a dark place through a hole of any shape, it is possible to see the crescent-shape getting smaller as the moon covers the sun.'[3]

Georges Potonniée quotes an interesting passage from a manuscript almanack written in Latin by the French astronomer GUILLAUME DE SAINT-CLOUD in 1290.[4]

> In the year of Our Lord 1285, on the 5th day of June, it happened that those who too intently observed the sun [during the eclipse] found their vision was impaired when they went into the shade again. This dazzled condition lasted with some two days, with others three and with some others several days, according to the length of time they had stared at the sun and the degree in which their eyes were sensitive. . . . In order to eliminate this and to be able to observe without danger the beginning, the end, and the extent of the eclipse, one should make in the roof of a house, or in the window, an opening towards that part of the sky where the eclipse of the sun will appear, and the size of the hole should be about the same as that made in a barrel for the purpose of drawing off wine. Opposite the light of the sun entering through this opening, should be placed, at a distance of twenty or thirty feet, something flat, for instance a screen. A ray of light will then be seen delineating itself on the screen in a round shape, even if the aperture is angular. The illuminated spot will be bigger than the opening, the larger, in fact, the further the screen is moved away from it, but then the image will be more feeble than if the screen is placed closer.

Guillaume went on to explain that the observers will see the diminution of the image of the sun's disk on the screen begin on the reverse side to where it is in reality, and illustrates it with a figure almost identical with Bacon's.

References to observing solar eclipses in the camera obscura, to avoid harming the eyes, occur in *De sinibus chordis et arcubis* translated in 1342 from the Hebrew of LEVI BEN GERSHON, a Jewish philosopher and mathematician who lived at Arles in Provence, *c.* 1288–1344, and in *Cosmographia* (Venice, 1543) of FRANCISCUS MAUROLYCUS, astronomer and professor of mathematics at Messina. In 1542 the German mathematician ERASMUS REINHOLD describes in his edition of Georg

Peuerbach's *Theoricae novae planetarum* the same method of observing eclipses, remarking that by this means one can see things going on in the street as well.[5] Reinhold's pupil REINERUS GEMMA-FRISIUS, a Dutch physician and mathematician, Pl 1 illustrates this method of observing a solar eclipse in January 1544 at Louvain, and this is the first published illustration of the camera obscura.[6]

The fallacy that the painter Leon Battista Alberti invented the camera obscura is probably based on a misunderstanding of a statement by Vasari in his *Lives of the Painters, Sculptors, and Architects.*[7] In the chapter on Alberti we are informed: 'In the year 1457 in which John Gutenberg, a German, discovered the most useful art of printing books, Leon Battista likewise made a discovery for representing landscapes and for diminishing and enlarging figures by means of an instrument, all good inventions useful to art.' The comparison of Alberti's invention with Gutenberg's certainly implies something very important. Yet the apparatus referred to by Vasari was none other than Alberti's 'intersector', an instrument for drawing by squares, described in Alberti's *Treatise on Painting*. The Milan edition of Vasari's work[8] includes a life of Alberti in Latin by an anonymous author, in which it is said that he had some show-boxes in which pictures painted on a transparent base and illuminated from behind looked startlingly real when viewed through an aperture in the box. This caused some authors to believe that Alberti had invented a small camera obscura, but, judging from the description, the instrument was merely a *viewing*-box in which one could see paintings of day and night scenes, such as the moon rising over rocks and mountains. Everyone knows the luminous magical effect characteristic of transparencies, compared with pictures seen ordinarily by reflected light. Such viewing- or show-boxes have never failed to delight, ever since Alberti apparently first demonstrated the effect. Much of Gainsborough's time was absorbed by one; he specially painted for it a dozen or more landscapes on glass. These were illuminated by five candles from behind, with a silk screen interposed to diffuse their light, and seen through a magnifying lens, the focus of which was adjustable.[9]

LEONARDO DA VINCI gives two clear descriptions of the camera obscura in his notebooks. One is in the Codex Atlanticus,[10] the other in Manuscript D.[11] In the latter, in comparing the eye with a camera obscura which he called *oculus artificialis*, Leonardo writes:

> When the images of illuminated objects pass through a small round hole into a very dark room, if you receive them on a piece of white paper placed vertically in the room at some distance from the aperture, you will see on the paper all those objects in their natural shapes and colours. They will be reduced in size, and upside down, owing to the intersection of the rays at the aperture. If these images come from a place which is illuminated by the sun, they will seem as if painted on the paper, which must be very thin and must be viewed from the back. The hole should be made in a piece of very thin sheet iron.

These descriptions dating from *c.* 1490 remained unknown in Leonardo's notebooks for almost three centuries until Venturi deciphered and published them in 1797.[12] The earliest *published* account of the camera obscura is contained in the first Italian edition (1521) of Vitruvius's *Treatise on Architecture*[13] in the form of the translator's annotation. CESARE CESARIANO, a pupil of Leonardo, in elucidating Vitruvius's use of the word *spectaculum*, gives an up-to-date meaning of it. He describes a device used by a Benedictine monk and architect, Don Papnutio, in proving a law of optics.

> Cut a circular concavity about 2 inches in diameter in a piece of wood about 4 or 6 inches in size, then place in the centre of the concavity a small and very short tube

> [*spectaculum*] or aperture, which is also called a sight. If you fix this properly in a panel of a door or in a window shutter, closed so that no light can enter, and if you have a piece of white paper or other material upon which [the images] of everything passing through the aperture may be received, you will see everything on the earth and in the sky with their colours and forms, according to the conical shape [*piramide*] of the hole.

The purpose of the conical or funnel-shaped hole was to give a wider field of view and admit more light.

GIROLAMO CARDANO, a physician and professor of mathematics at Milan and one of the great intellectuals of the Renaissance, also described the camera obscura before Porta in his famous scientific encyclopaedia *De Subtilitate* (1550).[14] What is more important, he appears to be the first to mention a bi-convex lens in conjunction with it.

> If you want to see the things which go on in the street, at a time when the sun shines brightly place in the window shutter a bi-convex lens [*orbem e vitro*]. If you then close the window you will see images projected through the aperture on to the opposite wall, but with rather dull colours; but by placing a piece of very white paper in the place where you see the images, you will attain the eagerly awaited result in a wonderful manner.

The French translation of Richard le Blanc (Paris, 1556)–'la rotondité faicte du verre'–corroborates our translation of 'bi-convex lens'.

The foregoing examples can hardly have left the reader in doubt that the camera obscura was a familiar phenomenon long before the sixteenth century. The common mis-attribution of its invention to the Neapolitan scientist GIOVANNI BATTISTA DELLA PORTA is due to the fact that he was the first to suggest its use for drawing, and that his description is much fuller than any of the previous ones. His book *Magiae naturalis* more than any other helped to disseminate knowledge of the camera obscura. It first appeared[15] in four 'books' in 1558 and a second greatly enlarged version in twenty 'books' came out thirty-one years later.[16] *Magiae naturalis* was one of the best-known works on popular science published during the sixteenth century.

In book iv, chapter 2, of the first edition is a description of 'the manner in which one can see in the dark all things on which the sun shines outside, and with their colours'. Porta explains that the room must be thoroughly darkened, and light admitted only through a single conical hole, the base of the cone being on the outside of the shutter and the apex towards the interior. Opposite the hole should be a white screen of paper or cloth.

> In this way you will perceive everything outside which is lit up by the sun, and you will see the people in the street walking upside down [*uti Antipodes*], and what is on the right will be on the left side and everything will be reversed. The images will appear the larger, the further the screen is from the hole, and the smaller, the nearer it is to the hole.

Porta remarks that in order to see the images distinctly, the spectator coming in from the sunny street must allow some time for his eyes to become accustomed to the dim light. He then reveals his 'carefully guarded secret' of receiving the images on a concave mirror ('a mirror, not one which dissipates by dispersing, but which congregates by uniting') set up opposite to the aperture, moving it to and fro until the place where the image appears is found. In this way the spectator can see clearly the 'faces, clothes, gestures, and movements of the passers-by, the clouds sailing in the blue sky, birds flying, and he will rejoice greatly to see the marvel'. He remarks that the images will be upside down because they will be near the centre of curvature of the mirror, but if received farther away than the centre they will appear larger and erect.

Camera obscura as an aid to artists. In the following we hear for the first time of the camera obscura as an aid to the artist:

> If you cannot paint, you can by this arrangement draw [the outline of the images] with a pencil. You will have then only to lay on the colours. This is done by reflecting the image downwards on to a drawing-board with paper. And for a person who is skilful this is a very easy matter.

Porta also mentions the use of the camera obscura for copying eclipses of the sun, and says that many other things appear which it would be impossible to describe in words but which a careful observer will notice.

In the thirty-one years which elapsed between the first publication and the second greatly enlarged version of *Magiae naturalis* Porta accumulated a vast knowledge of all branches of science, art, and nature, both from his own researches and extensive travels in Italy, France, and Spain, and from other scholars who used to gather at his house in Naples as members of his 'Academy of Secrets'. Each member was obliged to contribute something that was not generally known, and that might be useful. By this means Porta collected for his great work an amazing miscellany of information, and *Magiae naturalis* in twenty books became a kind of 'Outline of Modern Knowledge' in which serious scientific experiments are enlivened by practical jokes such as 'How to get rid of parasites from a rich man's table', and good advice on such delicate matters as 'How to correct the ill scent of the armpits'. Innumerable editions were published and translations appeared in Italian, English, German, Spanish, French, and Arabic–the English one, which is anonymous, is rather poor.[17]

The camera obscura is discussed in book xvii, chapter 6–'Other effects of the concave mirror'. Here Porta announces with great gusto, in the same way as he had previously revealed the use of the mirror, his secret of fitting a convex lens in the aperture, which should be 'about the width of the little finger'.

> If you put a lenticular crystal glass [*crystallinam lentem*] in the hole, you will at once see everything clearer, the faces of men walking in the street, the colours, clothes, and everything as if you stood nearby.

He recommends as before the use of a concave mirror in order to see things larger and clearer, and this is followed by the practical application of the camera to painting, which he now extends to *copying* paintings, and to *portraiture*, the sitters being placed at a suitable distance outside the room and in front of the aperture, and of course in direct sunshine.

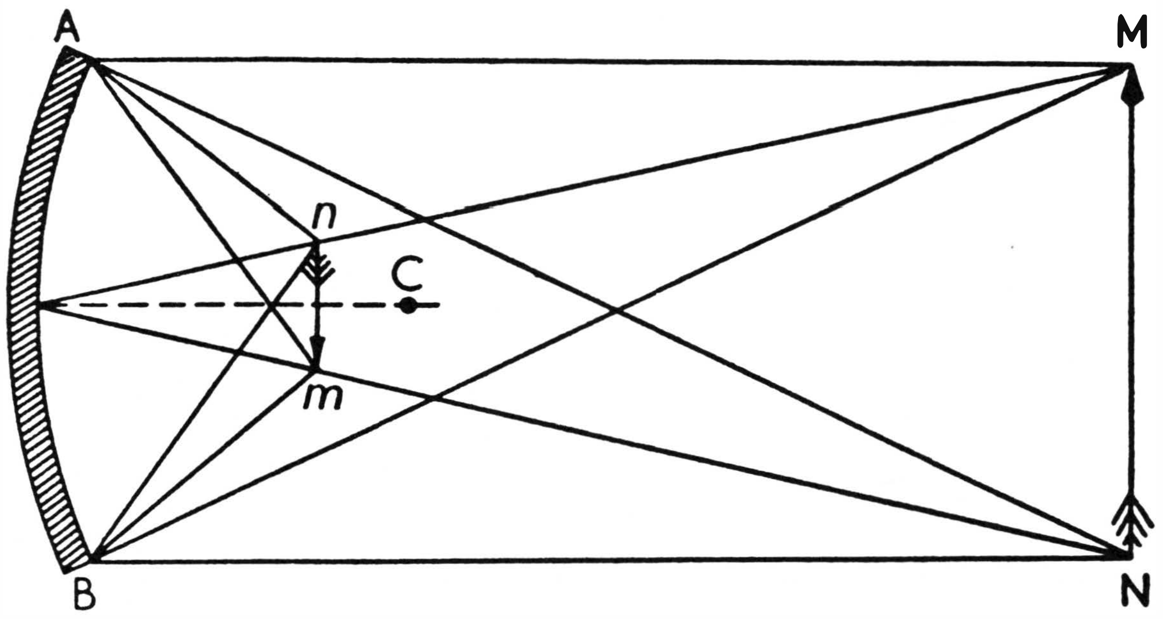


Fig 1 AB is a concave mirror whose centre is C. If nm is the inverted image received in its focus from the lens placed in the aperture of the window shutter, then MN will be the enlarged image reflected on the screen the right way up

Fig 1 Porta next explains how to make the images upright, a thing which, he says, many had tried to do in vain. He recommends putting a bi-convex lens (this time called *specillum e convexis fabricatum*) in the aperture and letting the image pass through it on to a concave mirror which should be so placed that its focus coincides with that of the lens, i.e. it will have to be at some distance *behind* the place where the image thrown by the lens appears sharp and upside down. The mirror will then reflect an enlarged image the right way up on to the screen, which is fixed just above the aperture (see figure 1 above).

Not content with observing simply what happens to be going on in the street, Porta then explains at length 'How in a chamber you may see hunting, battles of enemies, and other delusions.' He arranged elaborate theatrical productions on a sunlit stage just outside the dark room, with scenery, actors in costume, models of wild animals moved by children inside them, music, etc. The audience in the darkened room, unaware of this arrangement, were so thoroughly taken in by the spectacle they saw projected on a white sheet, that some could not believe Porta's explanations afterwards, and he was accused of sorcery. This kind of entertainment can, psychologically at least, count as the earliest forerunner of the cinema.

Porta's revelation of fitting a lens to the camera obscura was, of course, not a novelty but, like several other ideas, was most probably gleaned from Girolamo Cardano. DANIELE BARBARO, a Venetian nobleman and Patriarch of Aquileia, in his famous work on perspective[18] published twenty-one years before Porta's enlarged edition, also mentions the camera obscura fitted with a bi-convex lens.

> Having made a hole as large as a spectacle glass in the window [shutter] of the room from which you wish to observe, take an old man's spectacle glass, convex on both sides, not concave as the glasses of youths with short sight. When this is fixed in the hole, shut all the doors and windows of the room so that no other light may enter except by the lens. If you then take a sheet of paper and place it in front of the lens, you will clearly see on the paper all that goes on outside the house. This you will see most distinctly at a certain distance, which you find by moving the paper nearer to or further away from the lens, until you have found the proper position. Here you will see the images on the paper as they are, with their gradations, colours, shadows, movements, clouds, the rippling of water, birds flying, and everything else, if the sun is shining brightly, for the sunlight has great power in bringing out the visible images.

Barbaro introduces a novelty–the use of a diaphragm to sharpen the image. This is the first mention of a device essential in photography.

> When you make the experiment, you should choose such glasses as do best, and you should cover the lens leaving only a little circle in the middle, which should be clear and open, and you will see everything with a still more lifelike effect. When you see, therefore, on the paper the outline of things, you can draw upon the paper with a pencil the entire perspective, and the shading and colouring as in nature; holding the paper firmly until you have finished drawing.

Not only was Porta forestalled in the use of a lens with the camera, but he was no less anticipated in his use of the concave mirror in the darkened room to make the images upright. This was mentioned by IGNATIO DANTI, a Florentine mathematician and astronomer, in 1573[19] and also by GIOVANNI BATTISTA BENEDETTI in a mathematical treatise published in Turin in 1585.[20] Incidentally, Benedetti also mentions a camera obscura with a bi-convex lens.

An ingenious device for viewing the scene outside when the whole room is intended to be used as a camera obscura was first described by DANIEL SCHWENTER, professor of mathematics and oriental languages at Altdorf, in 1636.[21] A wooden ball with a hole bored through its axis and a lens fitted at each end was fixed into an opening in the window-shutter. Pl 2 The two lenses were of different focal lengths, and when used together gave a shorter focus than either separately. When the ball was rotated the field of view was greatly extended, and Schwenter states that by this means the Nuremberg painter Johann Hauer and his son drew an enormous panorama of that city. In Johann Zahn's *Oculus artificialis* (1685-6) this device is referred to as 'scioptric ball' and 'globus'; later scientists called it 'ox-eye', for real ox-eyes were sometimes inserted by Kaspar Schott and other experimenters who wanted to prove the identity of the optical phenomenon of the camera obscura with that of the eye by observing the inverted image on the retina of the eye of an ox or other animal.[22]

THE PORTABLE CAMERA OBSCURA

So far we have discussed the camera obscura in its original form as a darkened room in a house. The first suggestion of a separate transportable apparatus comes from FRIEDRICH RISNER,[23] who is best known for his translation and publication of Alhazen's *Optics* in Latin in 1572. Risner mentions in the nineteenth theorem of his *Optics* the camera obscura for enlarging or reducing drawings, and suggests its application to the easy and accurate delineation of topographical views, recommending the construction of a light wooden hut for this purpose.

Pl 3 ATHANASIUS KIRCHER, a German Jesuit scholar, describes and illustrates this type of camera obscura in greater detail in *Ars magna* (1646).[24] Kircher was a leading scholar, professor of philosophy, mathematics, and oriental languages in Rome, where he founded a famous science museum – the Museum Kircherianum in the College of the Society of Jesus. When travelling in Germany he saw a portable camera obscura consisting of an outer cube made of lightweight but strong material. In the centre of each wall was a hole fitted with a lens. The inner cube was of transparent paper for drawing on, and its distance from the outer wall related to the focus of the lenses. The artist entered through a trapdoor in the floor. The whole structure was light enough to be carried by two men by means of two horizontal bars, like a sedan chair.

CHRISTOPHER SCHEINER, another German Jesuit scholar and a pupil of Kircher, used a refracting telescope with a small camera obscura attached for the observation of sunspots in 1617. The drawing-board on to which the picture was projected, was enclosed within a wooden framework covered with a cloth. Scheiner, who has a claim to have observed sunspots before Galileo or Fabricius, illustrates his instrument for projecting the image of the sun on a screen prior to *Rosa Ursina* (1630)[25] in a very rare work, namely on p. 91 of *Refractiones Coelestes, sive Solis Elliptici Phaenomenon Illustratum* (Ingoldstadt, 1617). This is the date he gives in *Rosa ursina* for his invention and use of the refracting telescope.

SIR HENRY WOTTON,[26] traveller and diplomat, first describes a portable tent camera obscura, used by the astronomer JOHANN KEPLER when making a survey of Upper Austria in his capacity as Imperial Mathematician. Writing to Sir Francis Bacon (Lord Verulam) in November 1620, Wotton says:

> Let me tell your Lordship a pretty thing which I saw coming down the Danuby, though more remarkable for the Application, than for the Theory. I lay a night at Lintz, the metropolis of the higher Austria: but then in very low estate, having

> been newly taken by the Duke of Bavaria: who, *blandiente fortuna*, was gone on to the late effects: There I found Keplar (*sic*), a man famous in the Sciences, as your Lordship knowes, to whom I purpose to convey from hence one of your Books, that he may see we have some of our own that can honour our King, as well as he hath done with his *Harmanica*. In this mans study, I was much taken with the draught of a Landskip on a piece of paper, methoughts masterly done: Whereof enquiring the Author, he bewrayed with a smile it was himself, adding he had done it *non tanquam Pictor sed tanquam Mathematicus*. This set me on fire: at last he told me how. He hath a little black tent (of what stuffe is not much importing) which he can suddenly set up where he will in a field, and it is convertible (like a Wind-mill) to all quarters at pleasure, capable of [accommodating] not much more than one man, as I conceive, and perhaps at no great ease; exactly close and dark save at one hole, about an inch and a half in the Diameter, to which he applies a long perspective-trunke, with the convex glasse fitted to the said hole, and the concave taken out at the other end, which extendeth to about the middle of this erected Tent, through which the visible radiations of all the objects without are intromitted, falling upon a paper, which is accommodated to receive them; and so he traceth them with his Pen in their natural appearance, turning his little Tent round by degrees till he hath designed the whole aspect of the field: this I have described to your Lordship, because I think there might be good use made of it for Chorography [topographical drawings]: For otherwise, to make Landskips by it were illiberall: though surely no Painter can do them so precisely.[27]

By 'perspective-trunke' Wotton meant Kepler's telescope, from which the concave lens had been removed. Kepler's tent camera obscura, which is an intermediate form between the darkened room and the box camera, was constructed 113 years or more Pl 4 before the ABBÉ NOLLET submitted his re-invention to the Académie Royale des Sciences in 1733.[28]

Kepler himself does not refer to the tent camera, but in his first book on Optical Astronomy[29] he mentions Porta's description of the room type and states that he made some observations of the sun by this means in 1600. In his second book, on dioptrics,[30] he discusses the optical laws involved in the camera obscura with lens.

Of special interest to photographers is Problem CV, p. 54, 'To depict with a concave and convex lens upon paper visible objects larger than by a single convex, but reversed', for this is the principle of the optical system employed in telephotography. Kepler explains it with a figure showing the dispersion of the rays by a concave lens after having passed through a convex lens. However, Kepler is not the inventor of the telescopic lens system nor was it first employed in Galileo's telescope two years earlier, as is popularly believed. The writings of two English mathematicians, Leonard Digges and his son Thomas, scarcely admit of doubt that the telescope was familiar to them. In Leonard Digges's treatise *Pantometria*,[31] finished and published by his son in 1571, occurs a passage which shows that they were well acquainted with the effects of a combination of concave and convex lenses in magnifying the image of a distant object.

> But maruellouse are the conclusions that may be perfourmed by glasses concave and convex of circulare and parabolicall fourmes, using for multiplication of beames sometime the ayde of glasses transparent, which by [re]fraction should unite or dissipate the images of figures presented by the reflection of other. By these kinds of glasses, or rather frames of them, placed in due angles, ye may not onely set out the proportion of an whole region, yea represent before your eye

> the lively ymage of euery towne, village, etc., and that in as little or great space or place as ye will prescribe, but also augment and dilate any parcell thereof, so that whereas at the firste apparence an whole towne shall present it selfe so small and compacte together that ye shall not discerne any difference of streates, ye may by applycation of glasses in due proportion cause any peculiare house or roume thereof dilate and show it selfe in as ample fourme as the whole towne firste appeared, so that ye shall discerne any trifle or reade any letter lying there open, especially if the sonnebeames may come into it, as playnly as if you were corporally present, although it be distante from you as farre as eye can discrye.

Digges does not describe the construction and we are left to presume that by 'frames' he means tubes, and by 'due angles', the proper distance apart of the lenses. He continues with a remark about the 'miraculous effectes of perspective glasses'–a term which came to be used during the seventeenth century to denote a telescope.

The earliest reference to a small portable box camera is contained in Schott's *Magia universalis* (1657). The Jesuit scholar KASPAR SCHOTT was another of Kircher's pupils, and professor of mathematics at Würzburg. In the first part, 'Magia optica',[32] which was also published separately, Schott mentions in the fourth book, apropos of Kircher's description already quoted, that he had been told of a much smaller camera obscura seen by a traveller in Spain. It was so small that it could be carried under the arm and under the cloak, and Schott comments that it is by no means necessary to have a camera so large as to insert one's body or head, for it would perfectly suffice to look through a small hole in the side. By way of practical demonstration, he made a little camera obscura consisting of two boxes, one slightly smaller so that it could slide within the other to adjust the focus (the type of camera, in other words, that was used in the early years of photography). When this camera was fitted with an adjustable tube containing two convex lenses, erect images were obtained.

By the middle of the seventeenth century tiny camera obscuras disguised as drinking-goblets and books are mentioned. In the former the light rays entered through a convex lens in the side of the stem of the goblet and were reflected by a small mirror fixed in the stem at 45° on to the surface of the wine (which had to be white). This amusing magic goblet, first mentioned by the French mathematician Hérigone[33] and illustrated in Johann Zahn's *Oculus*, enabled a host unobtrusively to keep an eye on his guests. Probably with the same idea of keeping watch, the German schoolmaster J. C. KOHLHANS[34] disguised his camera obscura as a book, called *opticum libellum*.

In England ROBERT BOYLE wrote, in one of his tracts (1669),[35] of a portable box camera he had constructed. After describing how to render a piece of opaque paper transparent by greasing it, Boyle says:

> If a pretty large box be so contrived that there may be towards one end of it a fine sheet of paper stretched like the leather of a drum head at a convenient distance from the remoter end, where there is to be left a hole covered with a lenticular glass fitted for the purpose, you may, at a little hole left at the upper part of the box, see upon the paper such a lively representation not only of the motions but shapes and colours of outward objects as did not a little delight me when I first caused this portable darkened room, if I may so call it, to be made; which instrument I shall not here more particularly describe because I showed it to you several years ago,[36] since when divers ingenious men have tried to imitate mine (which you know was to be drawn out or shortened like a telescope, as occasion required) or improved the practice.

The previous year ROBERT HOOKE had read a paper to the Royal Society[37] on 'A contrivance to make the picture of anything appear on a wall, cupboard, or within a picture-frame, etc., in the midst of a light room in the daytime, or in the night time in any room which is enlightened with a considerable number of candles'. This arrangement, which Hooke called 'camera lucida', consisted in reflecting images from a mirror through a convex lens and thence through a large hole in the wall on to a white screen in a light room, but it has nothing to do with the camera obscura, depending on the great brightness of mirror reflections for its effect.

Pl 5 A quaint portable camera obscura was, however, also described by Hooke in one of his lectures on light, delivered to the Royal Society during January and February 1680.[38] Hooke's 'perspective box', though made only to demonstrate the laws of vision, has all the features of a camera obscura for drawing, except that it lacks a hole for the insertion of the artist's hand. The large hole in the side was for insertion of the head, covered with a cloth. Outwardly the camera looks rather like a bomb; it is of the same conical form, 4 to 5 ft long, the pointed end containing the convex lens, and the back, which Hooke mentions should be white and concave, is adjustable so that it could be moved nearer to or farther away from the lens. The reason for the concavity of the receiving screen at the back lies in the fact that the bi-convex lens, owing to its curvature, throws a curved image (the retina is also curved): on a plane screen only part of the image can be sharp–either that formed by the centre rays, or that formed by the outer rays, depending on which one focuses. A novel feature is the use of diaphragms of different sizes to be put over the lens to demonstrate the expansion and contraction of the pupil of the eye. Another improvement is a ball-and-socket head underneath the camera, enabling it to be easily turned in different directions. This is probably the first application of this particular device to the camera.

Some years later Hooke adapted the instrument for drawing, and on 19 December 1694 he communicated a paper to the Royal Society on 'An Instrument of use to take the Draught or Picture of anything'.[39] Referring to the very imperfect way in which books of travel are illustrated, Hooke thought it of general interest

> to promote the Use and Practice of some such contrivance, whereby any Person that can but use his Pen and trace the Profile of what he sees ready drawn for him, shall be able to give us the true Draught of whatever he sees before him, that continues so long time in the same posture as while he can nimbly run over, with his Pen, the Boundaries or Outlines of the Thing to be represented, which being once truly taken, it will not at all be difficult to add the proper Shadows and Light pertinent thereunto. . . . The Instrument I mean for this purpose is nothing else but a small Picture-Box much like that which I long since shewed the Society, for Drawing the Picture of a Man, or the like; of the Bigness of the original or of any proportionable Bigness that should be desired, as well bigger as smaller than the Life, which I believe was the first of that kind which was ever made or described by any. And possibly this may be the first of this kind that has been applied to this Use.

Pl 6 The woodcut accompanying Hooke's description shows a man standing in a landscape, his head inside a conical-shaped camera, in the act of sketching the outlines on transparent paper. How the camera was fixed at eye-level is not shown; presumably it was mounted on a stand.

Meanwhile (in 1676), JOHANN CHRISTOPH STURM, professor of mathematics at Altdorf University, had described and illustrated[40] a portable reflex camera obscura for drawing–the first of its kind. In this, a plane mirror set at an angle of 45° to the lens reflected the image right way up on to a piece of oiled paper stretched across the camera and, to improve visibility, shaded by a box-shaped paper hood in which the head and hand of the artist were inserted.

In 1685 JOHANN ZAHN, a Premonstratensian monk of Würzburg, and the leading representative of German monastic learning, illustrated several types of very neat little box cameras which could be taken about anywhere.[41] Pl 7

The reflex type illustrated in Fundamentum I consisted of a wooden box about 9 in. in height and breadth and about 2 ft long, more or less, depending on the focal length of the lens combination to be used. The lenses were arranged in an adjustable tube by means of which the image was focused on the oiled paper or opal glass screen (the first published reference to the focusing-*glass*) on to which it was reflected, right way up, by a plane mirror set at an angle of 45° to the axis of the lens. To shade the image, the camera lid was provided with side flaps. The box and lens-tube were painted black inside to avoid internal reflections.

In Fundamentum III Zahn illustrates a small box camera fitted with a tele-lens combination consisting of a convex lens of longer and a concave lens of shorter focal length by means of which an enlarged inverted image was received on the focusing-screen. As we have seen, this tele-lens combination was known to Leonard Digges over a century earlier, but this is the first time that the system was incorporated in the camera obscura.

In size and construction, Zahn's cameras are prototypes of nineteenth-century box and reflex cameras. It is really remarkable that no further development took place until the middle of the nineteenth-century: *in 1685 the camera was absolutely ready and waiting for photography.*

By the beginning of the eighteenth-century the camera obscura in its various forms had become a craze. It was, in the words of JOHN HARRIS,[42] 'One of the finest sights in the world', and never failed to enrapture spectators. Lengthy descriptions of it now found their way into most works on optics, treatises on painting, encyclopaedias, and books of popular entertainment. As an aid in painting its use was widespread, and such phrases as 'Everything is represented with such exquisite exactness as far surpasses the utmost skill of any painter to express'[43] constantly recur as if to challenge artists. Not only artists and scientists, but travellers also drew with the camera obscura to an extent that would have pleased Robert Hooke greatly. DR WILLIAM CHESELDEN, Surgeon to Queen Caroline, mentions in the preface to his famous *Osteographia*[44] (1733) that the illustrations were drawn with the aid of a camera obscura 'with which we corrected some of the few designs already made, throwing away others which we had before approved of, and finished the rest with more accuracy and less labour, doing in this way in a few minutes more than could be done without in many hours, I might say in many days'. The title-page bears an engraving of a man copying a skeleton, which is hung upside down in order to get it the right way up in the camera. Pl 9

COUNT FRANCESCO ALGAROTTI, adviser on art to Augustus III of Saxony and Frederick the Great of Prussia, in his *Essay on Painting* (1764)[45] recommends artists 'to make the same use of the camera obscura, which naturalists and astronomers make of the microscope and telescope. For all these instruments equally contributed to make known and represent Nature . . . The best modern painters among the Italians have availed themselves greatly of this contrivance (camera obscura); nor is it possible that they should have otherwise represented things so much to the life. It is probable too, that several of the Tramontane masters, considering their success in expressing the minutest objects, have done the same . . . Let the young painter, therefore, begin as early as possible to study these divine (camera obscura) pictures, and study them all the days of his life, for he never will be able sufficiently to contemplate them.'

For the convenience of travellers, the camera obscura was now incorporated in Pl 10 sedan chairs[46] and in carriages.[47] All that was necessary was to use a dark material for the interior, and have well-fitting curtains, and a little table to draw on. The lens was fixed in the roof and the image reflected on to the table by a mirror. By this means the traveller could make sketches in a most convenient way whenever he came to a beauty-spot.

Pl 11 GEORG BRANDER in 1769 illustrates[48] a charming rococo table model, with several Pl 12 extensions giving longer focal length for close-ups whilst in GUYOT's table model[49] the viewpoint is curiously low, somewhat reminiscent of some modern photographers' antics to get an unusual angle.

In striving for increased portability, some miniature camera obscuras (6 in. to 8 in. long and 2 or 3 in. wide) were made about this time, intended to be carried in the pocket, or disguised in the form of a book. Some were even small enough to be inserted in the heads of walking-sticks! Before 1764 JOSEPH HARRIS mentions all three types[50] and also tells of Dr Hoadly who built himself a pentagonal camera obscura on top of his house in Chelsea, in which he obtained five pictures at once. The 'living pictures' with moving people and animals, flying birds, shaking foliage and smoking chimneys, have fascinated people from Porta on. Anyone who has visited one of the few remaining public camera obscuras built in pavilions and towers in the early nineteenth century, such as those in Edinburgh on the Castle Hill, at Clifton near Bristol (1829), on the Hoe at Plymouth and at Kirriemuir, Scotland, will understand the great attraction which these natural movies have retained to this day.

Pl 13 The widespread use of the camera obscura in the eighteenth and early nineteenth century can be gauged from the many references to it in contemporary literature. To select only three:

A passage in *Tristram Shandy* shows that it is not only in the days of photography that complaints were made against camera portraits. Commenting upon the ways of great historians Sterne writes: 'One of these you will see drawing a full-length character against the light; that's illiberal, dishonest, and hard upon the character of the man who sits. Others, to mend the matter, will make a drawing of you in the camera; that is most unfair of all, because there you are sure to be represented in some of your most ridiculous attitudes.'[51]

Goethe, who experimented with the camera obscura,[52] tells in *Elective Affinities*[53] of an English gentleman who always took a camera obscura on his travels, and had in this way got together a large and most interesting collection of drawings which never failed to arouse admiration. This may well have been James Bruce, F.R.S., who describes a hexagonal camera obscura six feet in diameter, with a conical top in which the draughtsman sat unseen, as in a summerhouse.[54] Bruce, who was British Consul in Algiers in 1763 prior to his Nile expedition, also made archaeological tours in Barbary, and visited Palmyra and Baalbek. Sir R. Playfair relates[55] that on all these travels Bruce and his Italian companion Luigi Balugani made extensive use of a large book camera obscura made to Bruce's specification by Nairne & Blunt, London, as well as of a smaller camera made in Rome. The drawings made with these cameras were presented by Bruce to King George III and a number of them have been identified at the Royal Library, Windsor Castle. As there are two sketches of nearly every monument, though not exact duplicates, Playfair came to the conclusion that Bruce and Balugani drew with these two instruments at the same time and within talking distance of each other.

Edward Dodwell relates in his *Classical and Topographical Tour through Greece*[56] an amusing experience he had while sketching with the camera obscura on the Acropolis in 1805. The Turkish governor (Disdar) constantly put difficulties in Dodwell's way, which could only be overcome by 'gifts' until one day he got rid of this mercenary Turk in a most extraordinary manner. When Dodwell tried to explain the camera obscura

> The Disdar no sooner saw the temple instantaneously reflected on the paper in all its lines and colours, than he imagined that I had produced the effect by some magical process; his astonishment appeared mingled with alarm. . . . He again looked into the camera obscura. At that moment, some of his soldiers happening to pass before the reflecting glass, were beheld by the astonished Disdar walking upon the paper: he now became outrageous, and after calling me pig, devil and Buonaparte he told me that if I chose I might take away the temple and all the stones in the Citadel, but that he would never permit me to conjure his soldiers into my box. When I found that it was in vain to reason with his ignorance, I changed my tone, and told him that if he did not leave me unmolested, I would put *him* into my box, and that he should find it a very difficult matter to get out again.

Visibly alarmed, the Disdar immediately retired discomfited, and henceforth carefully avoided Dodwell and his dangerous box.

Before leaving this chapter we should mention an important improvement respecting the optics of the camera obscura. The English optician JOHN DOLLOND in 1758 made public[57] a new lens system by means of which chromatic aberration was avoided. A similar invention had actually been made, though not published, by Chester Moor Hall in 1733. Both his and Dollond's improvements were designed for the telescope. Zacharias Traber, Rector of the Jesuit College in Vienna, in his *Nervus Opticus* (1675), credits the Neapolitan Eustachio Divinus with the invention of an achromatic telescope. This had nineteen convex lenses enclosed in a tube 19 cubits long, and being made of very fine glass, prevented the discoloration of the image. Dollond combined two lenses of different dispersive powers, i.e. one of flint glass and one of crown glass, and such achromatic lenses have been employed in good optical instruments ever since.

WILLIAM HYDE WOLLASTON's *camera lucida*, introduced in 1807,[58] is *not* a camera at all–as is often mistakenly assumed, perhaps because Fox Talbot at one time drew with its aid–but a small optical instrument for drawing in broad daylight. By means of a prism, the artist saw a virtual image on his paper which facilitated the delineation of the object or view, but the image was not visible to anyone but the user of the instrument. It will be evident that there is no connection between this instrument and Dr Hooke's camera lucida already referred to; and in Wollaston's the name 'camera' was certainly misapplied. Pl 14

2 *Photochemical investigations*

It is a common fallacy that the blackening of silver salts by light was known to the alchemists of the Middle Ages and Renaissance. Those who cite Albertus Magnus (1193–1280), Georgius Agricola (1490–1555), Georgius Fabricius (1516–71), and Johann Rudolf Glauber (1604–68) as proof of their contention, can have little or no acquaintance with their works.

ALBERTUS MAGNUS mentions that nitrate of silver 'colours the human skin with a black colour very difficult to remove', but without attributing the effect to the action of light. AGRICOLA makes no reference to any of the silver salts at all. FABRICIUS[1] describes for the first time natural silver chloride–*argentum cornei* or horn silver, so called because it had the transparency of horn–and remarks that it is the colour of liver, soft like lead, and melts over a candle flame; but he says not a word of its tendency to change colour in light. The erroneous idea that Fabricius observed this is due to François Arago, who in his report on the daguerreotype process on 3 July 1839 added, 'This substance, exposed to light, passes from yellowish-gray to violet, and by prolonged action, almost to black.' The statement, coming from the mouth of such an eminent authority, has been generally accepted without question in spite of the fact that several historians have since pointed out Arago's error.

There are several passages in GLAUBER's *Opera chymica* (1658) relating to the use of nitrate of silver solution for staining hard-woods to look like ebony, and for dyeing leather and feathers black, but he also was apparently unaware of the cause of the change of colour.

In fact, the only two experimenters before Schulze who attributed the darkening of silver salts to the sun were Angelo Sala and Wilhelm Homberg. Sala wrote, in a pamphlet published in 1614,[2] 'When you expose powdered silver nitrate [*lapis lunearis*] to the sun, it turns black as ink.'

Wilhelm Homberg on 4 September 1694 exhibited to the Académie Royale des Sciences in Paris[3] among other things a small marbled box made of beef-bone. Having dipped the bone in a solution of nitrate of silver and blackened it by exposure to the sun, he gave it a marbled pattern by laying bare parts of the whitish bone beneath the blackened surface.

It remains a speculation whether either of these two scientists realized that the blackening of silver was due solely to the sun's *light*, and not to its heat. Homberg's contemporary, Robert Boyle, quite clearly attributed the effect to the air,[4] and even a century later Count Rumford argued that all changes produced in bodies exposed to sunlight were due to heat and not to light[5]–although before this ample proof had been forthcoming to the contrary.

The first person clearly to distinguish between the action of light and heat on silver salts was JOHANN HEINRICH SCHULZE, professor of anatomy at the University Pl 15 of Altdorf near Nuremberg. In 1725, while trying to make phosphorus, Schulze saturated chalk with nitric acid which happened to contain a little silver. He performed the experiment at an open window into which the sun was shining brightly, and to his astonishment noticed that the part of the precipitate facing the window turned purple, whilst the portion turned away from the light remained white. This phenomenon struck Schulze so forcibly that he put aside his original experiment in order to investigate its cause. Tests by the fire proved that it was not due to heat. Schulze then divided the mixture into two lots, one of which he kept in the dark, exposing the other to sunlight, with a thin cord tied round the bottle. When, after some hours' exposure, the cord was removed, he was delighted to find that the liquid under it had remained the same colour as that in the back part of the bottle, which no ray of the sun had reached. Schulze then refilled the bottle with the liquid kept in the dark, and covered it with paper, from which he had cut out words and entire sentences. 'Before long I found that the sun's rays on the side on which they had touched the glass through the apertures in the paper, wrote the words or sentences so accurately and distinctly on the chalk sediment, that many people curious in such matters but ignorant of the nature of the experiment, were led to attribute the result to all kinds of artifices.'

Believing that the darkening was attributable to the mixture of chalk and nitric acid–essential ingredients in making phosphorous by Balduin's process–Schulze made up a fresh mixture, but failed to repeat the effect. It was some time before he remembered that the first lot of nitric acid had contained a little silver. He then prepared a stronger silver mixture, adding chalk as before, and the discoloration took place much more rapidly–and was darker the larger the quantity of silver used. He also found that chalk could be replaced by other white powdery substances, the function of which was simply to make the dark words stand out by contrast, and that the effect was caused not only by direct sunshine but also by light reflected from a mirror or white wall.

Schulze communicated the details of his experiments to the Imperial Academy at Nuremberg[6] under the title 'Scotophorus pro Phosphoro Inventus'–a little joke turning on the paradox that the sun should produce darkness: Schulze had been looking for phosphorus, 'bringer of light', and discovered instead 'Scotophorus', 'bringer of darkness'.

It is evident from Schulze's posthumously published *Chemische Versuche*[7] that he attached considerable importance to his discovery of the light-sensitivity of carbonate of silver. There he mentions that if a silver solution is spread on the skin, on wood, or on bone, and exposed to the sun, it will turn black; and he stresses once more the importance of his discovery that the sun's light has chemical effects independent of heat. Nevertheless, Schulze's observation being incidental to other experiments, he did not seek any practical application of it. It did not occur to him to spread nitrate of silver on paper, for instance, and try to produce images by laying on stencils, or perhaps leaves, though even that would not have entitled him to be called 'the first photographer'. Professor Eder, who first drew attention in modern times (1881) to these experiments, called Schulze 'the inventor of photography', and in spite of numerous protests persisted in his claim in the various editions of his *History of Photography*. Of course, if we translate 'photography' literally as 'light-writing', Eder was right, for Schulze wrote words and sentences in the solution in his bottle, but the term 'photography' was introduced in 1839 specifically to denote the making of *permanent* pictures by the action of light. Yet from Schulze undoubtedly stems the whole genealogical tree of photochemistry which, combined with the camera obscura, eventually produced photography.

The first recorded application of nitrate of silver to paper is contained in a communication in 1737 to the Académie Royale des Sciences, Paris, by JEAN HELLOT[8] under the heading 'Sur une nouvelle encre sympathique'. Amongst other methods of secret writing he mentions the use of a weak silver nitrate solution which is invisible on white paper so long as it is kept in darkness. On exposure to the sun, the writing appears in the course of an hour, in a sort of slate colour. Hellot, however, ascribed this blackening of silver to the presence of sulphur in the nitric acid.

The discovery of the light-sensitivity of silver chloride belongs to GIACOMO BATTISTA BECCARIA, professor of physics at the University of Turin, who experimented on this substance in an analogous way to Schulze on carbonate of silver.[9]

DR WILLIAM LEWIS, F.R.S., of Kingston-on-Thames, repeated and confirmed Schulze's experiments in his *Philosophical Commerce of Arts* (1763).[10] This would not in itself be worth recording were it not for the fact that Dr Lewis forms an important link between Schulze and Wedgwood. The *Philosophical Commerce of Arts* is not only the first book published in England in which Schulze's experiment is described, but, what is far more significant, after Lewis's death in 1781 his notebooks containing his own experiments and compilations from other authors were bought by Josiah Wedgwood, the famous potter, who also took Dr Lewis's chemical assistant, Alexander Chisholm, into his service.[11]

Eliza Meteyard in her biography of Josiah Wedgwood[12] supplies the additional information that Chisholm had been with Dr Lewis for thirty years and entered Wedgwood's service at Etruria as secretary and chemical assistant in 1782. A highly educated man and a classical scholar, he became Josiah Wedgwood's right-hand man, and tutor to his youngest son Tom (then eleven years old) in classics and chemistry.

However, in order not to disturb the chronological order of events, we must first discuss the important photochemical researches of Scheele and Senebier, which preceded Wedgwood's photographic attempts.

CARL WILHELM SCHEELE, a Swedish chemist renowned for numerous important discoveries, also carried out experiments on the action of light upon chloride of silver. These are described in detail in his *Chemische Abhandlung*[13] (1777), which was translated into German, English, and French.

Scheele also confirmed that the blackening of silver salts is due to light and not to heat, and asked himself, 'Could it be that this black pigment is real silver?' To find out, he spread silver chloride powder on paper and exposed it to the sun for two weeks, when the surface of the white powder had become black. Knowing from Glauber and other early chemists of the solubility of chloride of silver in ammonia, Scheele poured some on the powder and found – as he expected – that it dissolved a quantity of the chloride of silver, but some black powder remained. This black precipitate proved to be metallic silver reduced by the action of light (para. 63).

The importance of Scheele's observation is his discovery that the blackened silver chloride had become *insoluble* in ammonia, and it is strange that this significant fact was overlooked by Wedgwood and Davy, whom it would have provided with at least a partially successful fixing agent. Thus we might have had photography about 1800.

Another experiment by Scheele, important for the history of photography, is described in paragraph 66 of *Chemische Abhandlung*. Allowing the solar spectrum to fall on powdered chloride of silver sprinkled on paper, Scheele found that the violet end of the spectrum had a far quicker blackening effect than the other rays, proving that the violet rays are much more actinic (chemically active) than the other colours of the spectrum. This discovery was only incidental in tests to prove that light cannot be considered as a simple substance or element, and Scheele attached no particular importance to this fact, which proved a source of constant difficulty to early photographers, resulting in a distorted rendering of the colours of nature in black-and-white.

JEAN SENEBIER, chief librarian of Geneva, made valuable photometric observations by exposing chloride of silver under varying thicknesses of paper, glass, and other substances. Extending Scheele's experiment with the solar spectrum he measured the time it took each coloured light to darken chloride of silver, and found that the red rays needed as many minutes as the violet rays seconds. His findings (published in 1782) for the whole spectrum showed the following effect:[14]

Under violet light	within 15 seconds
purple	25
blue	29
green	37
yellow	5½ minutes
orange	12
red	20

Senebier also made important investigations into the effect of light on resins and found that some lose their solubility in turpentine on exposure to light, i.e. they harden—a property later used by Nicéphore Niépce in his photographic experiments.

At the time Scheele and Senebier were publishing their researches, DR JOSEPH BLACK, F.R.S.—whom we shall shortly meet as a member of the Wedgwood circle—was giving his famous chemical lectures in Edinburgh.[15] In one of them he discusses the action of light in darkening chloride and nitrate of silver, coming to the same conclusion as Scheele, whom he cites, that by the action of light the silver salt is restored to its metallic state.

In 1800 (SIR) WILLIAM HERSCHEL, F.R.S., the great astronomer, observed during some thermometric experiments with the solar spectrum[16] that there were heat rays beyond the visible red rays, and these were subsequently called infra-red rays.

This led J. W. RITTER, a chemist of Jena, to investigate the solar spectrum further, and, following the method of Scheele, he discovered the invisible ultra-violet rays at the other end of the spectrum. (Herschel's thermometrical method would have been useless in investigating the ultra-violet rays, which are cold.)

> On the 22nd February [1801] I came upon solar rays on the violet side of the colour spectrum and beyond it, and indeed proved it by means of horn silver [chloride of silver]. They reduced even more strongly than the violet light itself, and the extent of these rays is very great.[17]

Ritter exposed to the solar spectrum in a dark room a strip of white paper coated with freshly precipitated silver chloride, and observed that the darkening action began rapidly *beyond* the visible violet rays, and then proceeded to the violet, etc. In other words, Ritter not only discovered the ultra-violet rays, but he observed that they are chemically more powerful than the luminous rays.

About this time, and independently of Ritter, DR WILLIAM HYDE WOLLASTON, F.R.S., followed up Herschel's and Scheele's researches and also observed the action of the invisible ultra-violet rays: 'It is by their chemical effects alone', he wrote,[18] 'that the existence of these can be discovered; and by far the most delicate test of their presence is the white muriate [chloride] of silver.'

From that time on, the rays beyond the violet, which are, as Ritter and Wollaston pointed out, chemically the most effective, were called 'the chemical rays' to differentiate them from the luminous rays which are chemically far less effective, as Senebier had already shown in his table.

Whereas these scientists carried Schulze's and Scheele's experiments farther to widen their knowledge of the nature of light, a large number of books of popular scientific entertainment which appeared in the latter half of the eighteenth century included Schulze's experiment simply as an amusing recreation. The first of these is Guyot's four-volume *Nouvelles Récréations* (1769–70) which was translated into German and English–for Dr William Hooper's *Rational Recreations* (1774) is *not* an original work but virtually a translation of Guyot's book–a fact which has not to our knowledge been pointed out before. Hooper's four-volume *Rational Recreations* enjoyed no less popularity than Guyot's, further editions being published in 1782, 1783, and 1787. Taking the first edition of 1774 we find Schulze's experiment in vol. iv under the title 'Writing on glass by the rays of the sun'; and in following years this recreation was reprinted verbatim in Kearsley's *Pocket Ledger*. Hellot's method of secret writing with nitrate of silver is also given in Guyot and Hooper. It would be tedious to list all the publications containing Schulze's experiment. It was widely disseminated in France, Germany, and England, and it did not, therefore, require a great deal of imagination to apply it to picture-making, though curiously enough none of the scientists engaged on investigations into the chemical change of silver salts under the influence of light seems to have thought of making practical use of it, in the sense of trying to cause the sun's rays to make impressions of objects, portraits, or landscapes. The first person to whom the idea of Nature-printed pictures occurred was not a scientist but a writer of fiction.

3 *Phantoms of photography*

TIPHAIGNE DE LA ROCHE made a remarkable forecast of photography in chapter 18 of his book *Giphantie* (1760)[1] – an anagram on the author's Christian name. The English translation is aptly subtitled 'A view of what has passed, what is now passing, and during the present century what will pass in the world', for *Giphantie* is a book of fantasies or prophetic fiction *à la* Jules Verne and H. G. Wells. It is the supposed narrative of a person who is carried to a mysterious island, *Giphantie*, in the quicksands of the desert. The Governor of the island, which is inhabited by 'elementary (*sic*) [elemental] spirits', shows the traveller into a room where he sees from the window a storm at sea. Unable to believe his eyes at the sight of the ocean in the middle of Africa, he runs to look out of the window, but alas, there is no window, which he notices only when he bangs his head against something hard. Stunned, he draws back, and the Governor explains:

> That window, that vast horizon, those black clouds, that raging sea, are all but a picture. . . . You know that the rays of light, reflected from different bodies, form a picture, and paint the image reflected on all polished surfaces, for instance, on the retina of the eye, on water, and on glass. The elementary (*sic*) [elemental] spirits have sought to fix these fleeting images; they have composed a subtle matter, very viscous and quick to harden and dry, by means of which a picture is formed in the twinkling of an eye. They coat a piece of canvas with this matter, and hold it in front of the objects they wish to paint. The first effect of this canvas is similar to that of a mirror; one sees there all objects, near and far, the image of which light can transmit. But what a glass cannot do, the canvas by means of its viscous matter, retains the images. The mirror represents the objects faithfully, but retains them not; our canvas shows them with the same exactness, and retains them all. This impression of the image is instantaneous, and the canvas is immediately carried away into some dark place. An hour later the impression is dry, and you have a picture the more valuable in that it cannot be imitated by art or destroyed by time. . . . The correctness of the drawing, the truth of the expression, the stronger or weaker strokes, the gradation of the shades, the rules of perspective, all these we leave to nature, who with a sure and never-erring hand, draws upon our canvasses images which deceive the eye.

It is quite possible that this episode was inspired by one of the fables of Fénelon describing a voyage to an imaginary country,[2] in which the following passage occurs:

> There was no painter in that country, but if anybody wished to have the portrait of a friend, of a picture, a beautiful landscape, or of any other object, water was

> placed in great basins of gold or silver, and then the object desired to be painted was placed in front of that water. After a while the water froze and became a glass mirror, on which an ineffaceable image remained.

In one of E. T. A. Hoffmann's fantastic tales a man gives his beloved a mirror on which his reflection is permanently fixed.

Whereas Tiphaigne de la Roche invented a fantasy in all probability inspired by Fénelon or by seeing the images of a camera obscura, LORD BROUGHAM, F.R.S., created a myth concerning his alleged knowledge of photography which he quite seriously believed himself and which equally convinced various uncritical writers. In his autobiography[3] Brougham states that in 1794–5 he was engaged in experiments upon light and colours, which he incorporated in a communication to the Royal Society in 1795 (published in the *Philosophical Transactions*, 1796).

> But Sir Charles Blagden, the Secretary, desired parts to be left out as belonging rather to the arts than to the sciences. This was very unfortunate, because having observed the effect of a small hole in the window shutter of a darkened room, when a view is formed on white paper of the external objects, I had suggested that if that view is formed, not on paper, but on ivory rubbed with nitrate of silver, the picture would become permanent, and I had suggested improvements in drawing, founded upon this effect. Now this is the origin of photography; and had the note containing the suggestion in 1795 appeared, in all probability it would have set others on the examination of the subject and have given us photography half a century earlier than we have had it.

Even if Lord Brougham's account had been published, it would in no way have influenced the invention of photography. First of all, it was only a suggested experiment; in practice it would have been impossible to obtain a picture in the way described, for the light would have been too feeble to affect the not very sensitive silver nitrate. Secondly, how would he have *fixed* the light image?

In introducing the daguerreotype process in 1839 Arago referred to a tradition according to which in the first years of the nineteenth century the famous physicist PROFESSOR JACQUES CHARLES, inventor of the hydrogen balloon (1783), is supposed to have made silhouette portraits on paper coated with silver salts, as demonstrations during his lectures on experimental science which he gave for thirty years, first at the Louvre, and later at the Conservatoire des Arts et Métiers. Silhouettes were then at the height of their popularity, and it would not be surprising if it should have occurred to Charles to demonstrate the well-known blackening of silver salts in light in this way. But since some historians of photography have proffered detailed descriptions of his procedure, provided dates, and even imaginary illustrations of the demonstration, it should be stressed that neither Professor Charles himself nor his biographer, Baron Fourier, makes any reference to this matter. One French writer[4] even made Charles into an Englishman; could it be that Arago had heard of the work of the well-known London silhouettist A. Charles and got confused? However that may be, there is in fact no contemporary evidence whatsoever to substantiate Arago's remark, and in the circumstances it is best to leave the matter where Arago left it when he rightly said, 'The historian, under pain of falling into inextricable confusion, is not authorized to proceed except upon printed and authentic documents.'

4 The first conception of photography

We have already briefly referred to THOMAS WEDGWOOD in discussing the photochemical researches of Dr Lewis and the acquisition of his notebooks by Josiah Wedgwood. Apart from this, we have, it is hoped, left no doubt that anyone researching on light in the latter half of the eighteenth century was bound sooner or later to come across Schulze's experiment in some publication. It is therefore by no means astonishing that it should have occurred to Tom Wedgwood, the fourth and youngest son of Josiah Wedgwood, to make use of the knowledge of the darkening of silver salts in the hope of retaining the images of the camera obscura, with which he was familiar from his earliest years. Pl 16

On 14 August 1773 Josiah Wedgwood wrote to his partner Mr Bentley, 'I wish you could send me a good camera obscura, not too cumbersome, that I could take to the gentlemen's seats here',[1] the object being to ornament a service of china which had been ordered by Catherine the Great with views of 'the stately homes of England', by drawings sketched more rapidly and correctly with the aid of this instrument. The pictures were then copied on the china surface and burned in. The service was decorated with over 1,200 views and cost £3,000. Josiah Wedgwood was a practical-minded man, always ready to improve production methods and to back novel ideas, such as Francis Eginton's polygraphic process of producing facsimile prints of famous paintings.

The scientific atmosphere in which Tom Wedgwood was brought up is well illustrated by another letter of his father's to Mr Bentley, apropos of the family group to be painted by George Stubbs, R.A., *c.* 1780.

> The pendant [to the picture] to be Jack standing at a table making fixable air with the glass apparatus, etc., and his two brothers accompanying him; Tom jumping up and clapping his hands with joy and surprise at seeing the stream of bubbles rise up, just as Jack has put in a little chalk to the acid; Jos, with the chemical dictionary before him, in a thoughtful mood; which actions will be exactly descriptive of their respective characters.

Josiah Wedgwood belonged to a circle of eminent men, all liberal-minded and politically progressive, who banded themselves into a small and select scientific society, which flourished between about 1770 and 1790. Most of the leading scientists of Birmingham and its neighbourhood were members, and they usually met at each other's houses in rotation. As their residences were at considerable distances from each other, meetings were arranged at full moon in order to have the benefit of its light in returning home, and for this reason they called themselves the Lunar Society–

others inevitably dubbed them the Lunatic Society. It was a galaxy of famous names, including Dr Joseph Priestley, F.R.S., James Watt, F.R.S., improver of the steam engine; Matthew Boulton, F.R.S., Watt's partner at the Soho Engineering Works in Birmingham; William Murdoch, F.R.S., inventor of coal-gas lighting which was first used at Soho in 1803; Dr Erasmus Darwin, famous physician and botanist, and grandfather of Charles Darwin; the astronomer (Sir) William Herschel, F.R.S.; Sir Joseph Banks, F.R.S., naturalist and President of the Royal Society; Dr Joseph Black, F.R.S., famous chemist; Dr John Roebuck, F.R.S., another eminent chemist, and several others. A few of them can, of course, have been only corresponding members.

Tom Wedgwood was particularly fond of chemical experiments, and after studying at Edinburgh Univeristy (1786–8) devoted a year or two to investigations of the relations between heat and light. The results of this work were communicated to the Royal Society in his paper 'Experiments and Observations on the Production of Light from Different Bodies by Heat and Attrition' (1792).[2]

In this work Tom Wedgwood received much encouragement from Dr Priestley, one of the most erudite and enlightened men of his time, who was equally conversant with optics and chemistry. In his *History of Vision, Light and Colours*[3] Priestley discusses the camera obscura in part ii and Schulze's experiments in part vi. Priestley was also fully conversant with Scheele's photochemical investigations, for he contributed a chapter to the English translation of Scheele's *Chemische Abhandlung*, published in 1780.

It is unfortunate that Tom Wedgwood's biographer R. B. Litchfield[4]–though giving an excellent account of his life and character–was able to contribute little to the knowledge of his photographic experiments as described in (Sir) Humphry Davy's paper to the Royal Institution, 1802. Since not much information on that topic has been forthcoming from Litchfield, and that offered by Miss Meteyard has long since been exposed as a flight of imagination, we had to seek clues as to the books and people from whom Wedgwood might have derived information beneficial to his researches–Dr Lewis's notebooks and Alexander Chisholm, Dr Priestley, and Josiah Wedgwood's camera obscura.

The exact date of the beginning of Wedgwood's photographic experiments cannot be established. All we can gather from stray scraps of information is that they were probably carried out in the last year or years of the eighteenth century. There may be a possible clue to them in a letter from James Watt to Josiah Wedgwood, bearing the inadequate date 'Thursday'. This letter has been variously docketed 1790, 1791, and finally 1799. If it is of the last date, it must have been addressed to Tom's eldest brother and not to his father, who died in 1795. James Watt wrote, 'I thank you for your instructions as to the Silver Pictures, about which, when at home, I will make some experiments.' That is all, the rest of the letter refers to other matters. If we may assume that the silver pictures referred to were silver nitrate pictures, the reason for Josiah Wedgwood's sending instructions about them instead of Tom Wedgwood himself might lie in the circumstance that Tom suffered from ill-health all his life and travelled a great deal in search of relief.

(Sir) Anthony Carlisle, a well-known surgeon and at one time Professor of Anatomy at the Royal Academy Schools, stated in January 1839 that about forty years earlier he had participated in several of the photographic experiments of his friend Wedgwood.[5] 'We obtained a temporary image or copy of the figure [painting on glass] on the surface of the leather, which, however, was soon obscured by the effects of light.'

A letter from (Sir) John Leslie, a young scientific friend, provides another pointer. 'A few days ago', he wrote to Tom Wedgwood on 18 November 1800, 'I left at York Street [Wedgwood's London showrooms in Duke of York Street, just north of St James's Square] an object-glass and some thin cylinders for the solar microscope, and half a dozen bits of painted glass which will, I think, suit you. I have more pieces, which you may have at any time.' These bits of coloured glass were used in Tom Wedgwood's experiments on the effect of various coloured light on silver nitrate, which preceded his attempts to copy paintings upon glass. We learn about these experiments in the opening paragraph of (Sir) Humphry Davy's account.

Tom Wedgwood had become acquainted with HUMPHRY DAVY, then an apothecary's apprentice at Penzance, while wintering there in 1797–8. During the following year Wedgwood saw a good deal of Davy at Dr Beddoes's Pneumatic Institute at Clifton, near Bristol, of which the brilliant Davy had meanwhile become superintendent. Dr Beddoes, translator of Scheele's *Chemische Abhandlung*, had been obliged to resign his professorship of chemistry at Oxford on account of his approval of the French Revolution. Tom Wedgwood, perhaps more in sympathy with Beddoes's political views than with his 'pneumatic' treatment, made a substantial financial contribution towards the establishment of the Institute, as did his father and brothers. Now he became one of the patients, though without deriving any benefit from the treatment, which consisted in the inhalation of various gases. What Tom Wedgwood was suffering from the best medical skill of the time failed to discover, but he was too ill to do concentrated work for any length of time.

In 1801 the Institute failed, and Davy was shortly afterwards appointed director of the chemical laboratory of the Royal Institution, London, where in the following year he also became professor of chemistry. It was here that Davy repeated and extended the experiments which Wedgwood had told him about; indeed, it is more than likely that they repeated them together, for Tom Wedgwood was living in London from March to May 1802.

Davy was joint editor, with Dr Thomas Young, of the *Journal of the Royal Institution*, and for this reason we find the results of Wedgwood's researches embodied in that publication in the June issue, under the title 'An account of a method of copying paintings upon glass and of making profiles by the agency of light upon nitrate of silver. Invented by T. Wedgwood Esq. With observations by H. Davy.'[6]

Wedgwood's main object was to fix the images of the camera obscura, but in this he was unsuccessful.

> The images formed by means of a camera obscura have been found too faint to produce, in any moderate time, an effect upon nitrate of silver. To copy these images was the first object of Mr Wedgwood in his researches on the subject, and for this purpose he first used the nitrate of silver, which was mentioned to him by a friend as a substance very sensible to the influence of light; but all his numerous experiments as to their primary end proved unsuccessful.

The friend referred to can only have been Chisholm or Priestley. Had Wedgwood exposed for 6 to 8 hours (as Niépce was to do a quarter of a century later) he might have obtained a picture. We do not know what his limit was for 'any moderate time', but, failing, he fell back on the simpler method of superposition–as did Niépce and Fox Talbot–in which object and sensitive paper or leather were placed in contact in direct sunlight, a procedure which shortened the exposure to 2 or 3 minutes. White leather moistened with nitrate of silver was more readily acted upon than paper, he noted (owing to the gallic acid in the tannin). Wedgwood considered that this method of copying 'will be useful for making delineations of all such objects as are possessed of a texture partly opaque and partly transparent'.

'The woody fibres of leaves, and the wings of insects, may be pretty accurately represented by means of it.' When paintings-on-glass–then very fashionable–were laid on white leather coated with a solution of nitrate of silver, Wedgwood found that the rays passing through the different coloured glass acted with varying intensity on the nitrate of silver; in fact, his observations were analogous to those of Scheele and Senebier, and in a lengthy footnote Davy drew attention to this and referred to the further experiments of Herschel, Ritter, and Wollaston, which proves that Davy at any rate was acquainted with their photochemical investigations–an important point, as we shall see. When, however, an engraving was superimposed, the copy did not show a distinct resemblance to the original–presumably because the lights and shades were reversed.

'When the shadow of any figure is thrown upon the prepared surface, the part concealed by it remains white, and the other parts speedily become dark.' In this way Wedgwood obtained outlines of objects and profiles (silhouettes).

Though the images, once imprinted upon the paper or leather, could not be removed by water, or soap and water,

> No attempts that have been made to prevent the uncoloured parts of the copy or profile from being acted upon by light, have as yet been successful. They have been covered with a thin coating of fine varnish, but this has not destroyed their susceptibility of becoming coloured [darkened]; and even after repeated washings, sufficient of the active part of the saline matter will still adhere to the white parts of the leather or paper, to cause them to become dark when exposed to the rays of the sun.

Wedgwood warns, therefore, that the copy of the painting-on-glass, or the profile, must be put in a dark place immediately after being made. 'It may indeed be examined in the shade, but, in this case, the exposure should be only for a few minutes; by the light of candles or lamps, as commonly employed, it is not sensibly affected.'

Whilst Wedgwood had employed silver nitrate for his experiments, Davy found the chloride more light-sensitive, but he, too, failed to obtain images in the camera obscura. He extended Wedgwood's researches by copying enlarged images of small objects produced by means of the solar microscope, considering that 'This will probably be a useful application of the method; that it may be employed successfully, however, it is necessary that the paper be placed at but a small distance from the lens'. Davy ends his observations: 'Nothing but a method of preventing the unshaded parts of the delineation from being coloured [darkened] by exposure to the day is wanting, to render the process as useful as it is elegant.'

It is indeed surprising that Davy, who quotes the results of Scheele in his footnote, failed to deduce from the Swedish chemist's experiment that ammonia could be used to dissolve the chloride of silver unaffected by light, i.e. to render the image permanent. By a coincidence, in the same month and year, June 1802, Dr W. Hyde Wollaston read his paper on 'A method of examining refractive and dispersive Powers by prismatic Reflection' to the Royal Society. In it he also referred to Scheele's experiments (see p. 32), which he had repeated–and though he was naturally more interested in the blackening effect of invisible rays than in fixation, he must have read the paragraph about ammonia. One cannot absolve so eminent a chemist as Davy from blame for his failure to find a fixing agent. Talbot and Daguerre thought of using common salt, and neither of them was a chemist. One can only presume that Davy lacked the imagination to realize the importance of Wedgwood's experiments, and published them only to oblige his friend. Had he taken some trouble to solve this problem, their joint efforts might not have remained only an abortive attempt at photography.

Three years after the publication of his experiments Wedgwood died, at the early age of thirty-four. It is not known whether he resumed his photographic researches, or whether he ever asked one of his many other scientific friends about a fixing agent after Davy had failed to find one. His old friend Dr Priestley, who had emigrated to America in 1794, was still alive, and both Alexander Chisholm and Dr Beddoes outlived Wedgwood. So it was left to later experimentalists to complete the invention of which he had laid the foundation. Wedgwood's early trials with the camera, which, but for Davy's account, would have been completely lost to posterity, made an important contribution towards the ultimate success of photography, for it was he who first had the idea of photography and demonstrated its possibility, and this was an enormous step forward from Schulze. What happened to Wedgwood's experimental photographs, which are supposed to have survived until 1885, when they were seen by Samuel Highley?[7]

Eliza Meteyard made extravagant and quite unfounded claims for Wedgwood in her book *A Group of Englishmen* (1871),[8] and this in spite of the fact that the most glaring of her false theories had already been completely exposed several years before. The unwary should be warned that the 'Savoyard Piper', which Miss Meteyard called 'A facsimile of the earliest known heliotype or sun picture taken by the inventor of photography, Thomas Wedgwood, in 1791–1793' is a copy of an etching by Teniers now in the Sheepshanks Collection at the British Museum. As we have seen from Davy's paper, Wedgwood did not succeed in copying prints, nor indeed did he ever succeed in fixing a picture of any kind. Miss Meteyard must, therefore, have read Davy's paper with singular lack of attention and understanding.

She also refers to another picture which, she says, had been found at Etruria, Wedgwood's factory. It shows a table laid for breakfast, and Fox Talbot on seeing it was at once able to prove it to be one of his own early photographs, taken in 1841 or 1842, and this he stated in a letter to *The Photographic Journal*, 16 January 1864. Yet with extraordinary obstinacy Miss Meteyard illustrated this photograph in the second volume of her *Life of Josiah Wedgwood*, published two years later, and repeated her assertion once more in *A Group of Englishmen*, 1871. In this book she even speaks of the 'undoubted authenticity' of the Savoyard piper and the breakfast table as photographs by Wedgwood–ample proof of her complete unreliability in matters relating to Wedgwood's photographic experiments.

Not content, however, with claiming Wedgwood as 'the discoverer of modern photography' (which she insisted ought to be called 'Wedgwood-type' in justice to his memory) Miss Meteyard tried to construct a link between Wedgwood and Daguerre, on the ground that a certain Dominique Daguerre, who became agent for a few years for Wedgwood ware in Paris in 1787, was the father of L. J. M. Daguerre, inventor of the daguerreotype. Dominique Daguerre was a dealer in fine furniture, porcelain, glass, jewellery and 'novelties' at the Couronne d'Or in the Rue St Honoré, Paris, and in Sloane Street, London. He has been called 'the most fashionable Parisian *marchand-mercier* of his day', patronized by the French court, the Prince of Wales (later King George IV), and several Russian Grand Dukes.[9] Eliza Meteyard knew that Dominique Daguerre was accompanied to Etruria in 1791 and 1793 by a son. She rashly assumed that 'if he inherited his father's tastes, we may reasonably conclude that he was one and the same with the M. Daguerre who in

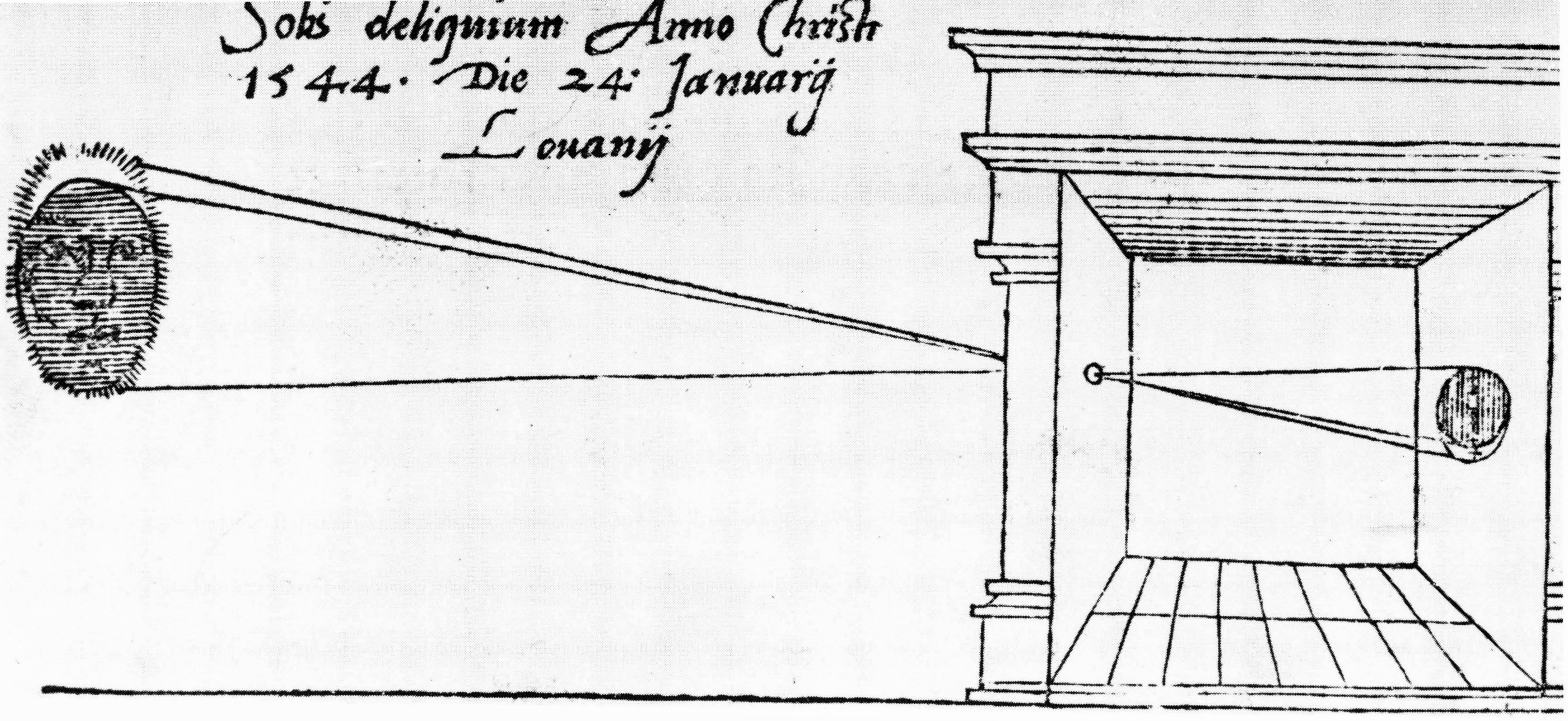
1824 improved the heliotype process. . . . He may have been led to these researches either through memory of what he had seen or heard of Thomas Wedgwood's experiments.' Miss Meteyard might not have been able to ascertain without considerable trouble that the Christian names of the father of the inventor of the daguerreotype were Louis Jacques, and not Dominique, and that he was a civil servant, not a china merchant; but she could easily have ascertained that the inventor of the daguerreotype was born in November 1787, so he would have been most unlikely to have any remembrance of a scientific process at Etruria in 1791 and 1793, even if there had been anything photographic to be seen. Dominique Daguerre might possibly have been an uncle or cousin of the inventor, but he could have told him precisely nothing about Wedgwood's experiments for the simple reason that they were not started until several years after his visits.

Though the *Journal of the Royal Institution* had only a very limited circulation, Wedgwood's experiments were reprinted verbatim soon afterwards in *Nicholson's Journal of Natural Philosophy, Chemistry and the Arts* (November issue, 1802), which was widely read. In addition, Sir David Brewster published a review of the experiments in the December issue of the *Edinburgh Magazine*, and extensive extracts from Davy's account were included in well-known chemical treatises such as Frederick Accum's *System of Theoretical and Practical Chemistry* (Accum was a colleague of Davy's at the Royal Institution), and John Imison's *System of Theoretical and Practical Chemistry*, both published in 1803.

DR THOMAS YOUNG, F.R.S., exponent of the undulatory theory of light, and another of Davy's distinguished colleagues, immediately applied Wedgwood's and Davy's findings to a different experiment. In his first Bakerian lecture[10] in November 1803 Dr Young related, apropos the newly discovered ultra-violet rays, that he had succeeded by means of the solar microscope in forming an image of the well-known 'Newton rings' on paper dipped in a solution of nitrate of silver and placed at the distance of about 9 in. from the microscope. In this way he proved the analogous behaviour of the invisible rays with the visible ones. Having gained by Wedgwood's and Davy's experience he mentions that 'leather, impregnated with the muriate [chloride] of silver, would indicate the effect with greater delicacy'. But as he was only interested in investigating the behaviour of light, Dr Young did not carry his experiments into the field of photography.

The next photographic experimenter was JOSEPH NICÉPHORE NIÉPCE, a Frenchman, who, finding himself in the same *cul-de-sac* as Wedgwood in not being able to fix his paper pictures, followed another line of research resulting in something totally different – a photograph on metal.

Plates 1–16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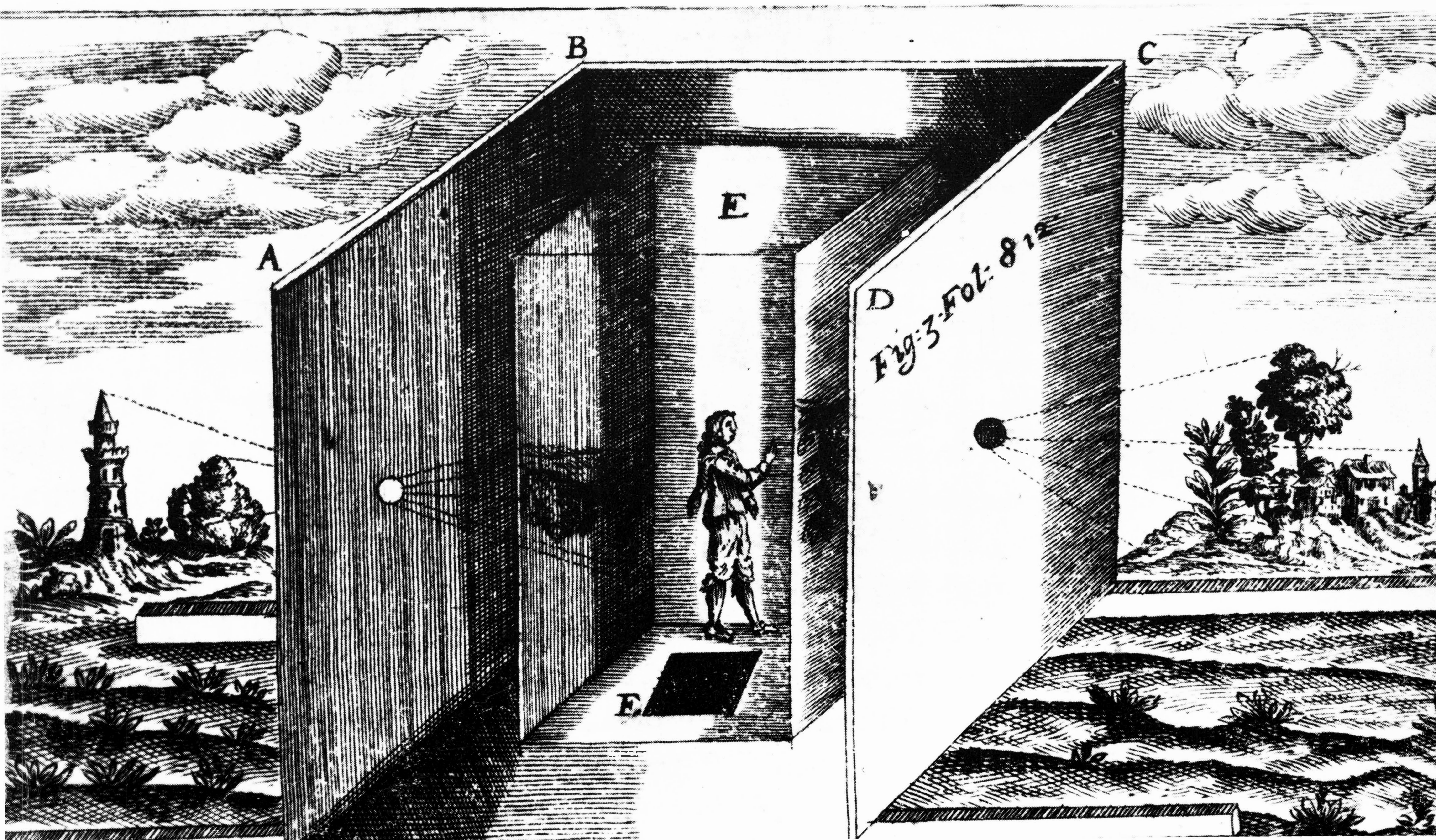
1 GEMMA-FRISIUS. First published illustration of a camera obscura: observing a solar eclipse in January 1544

2 Scioptric ball or 'ox-eye', *c.* 1650

3 ATHANASIUS KIRCHER. Large portable camera obscura, 1646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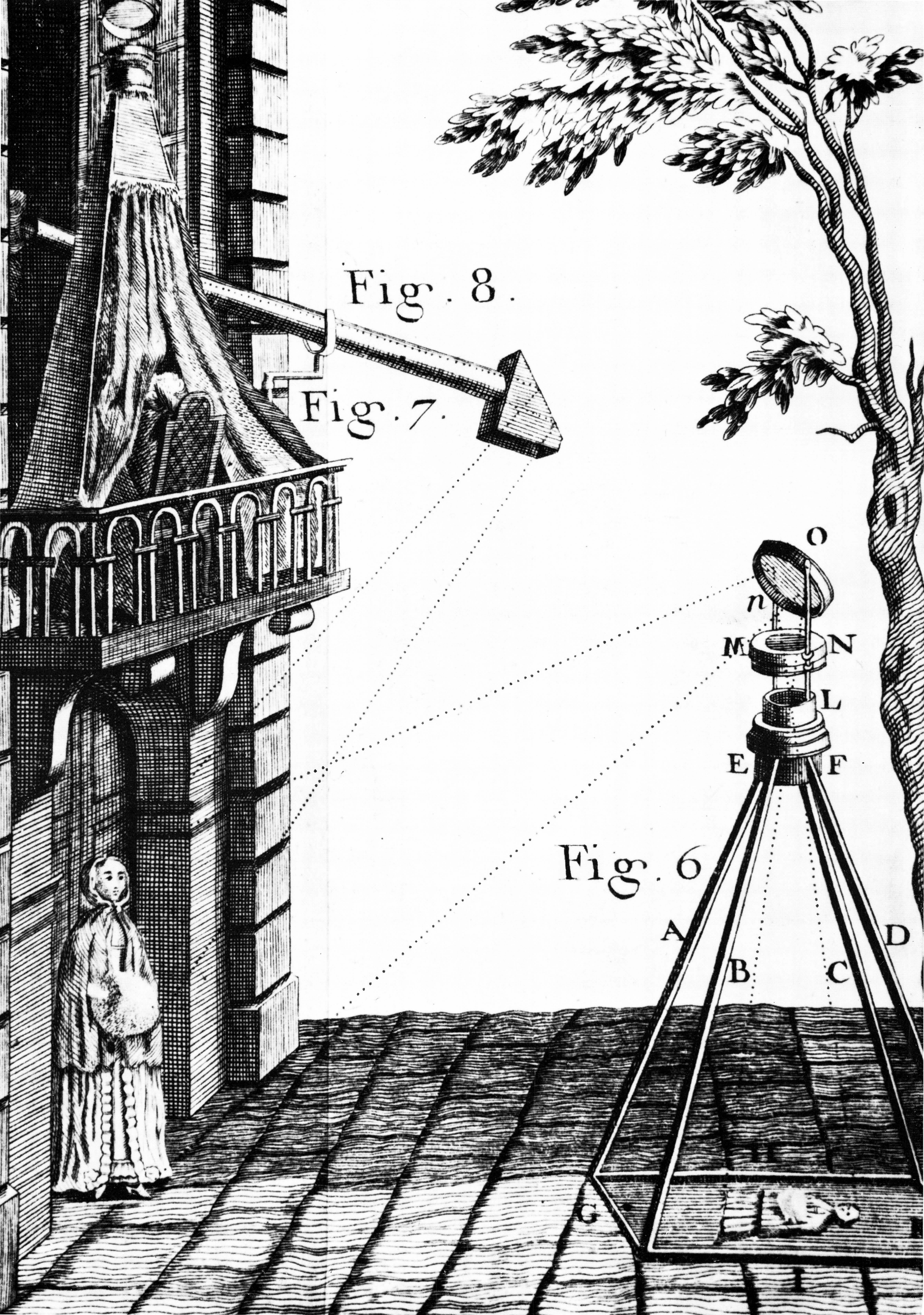

Fig. 8.

Fig. 7.

Fig. 6

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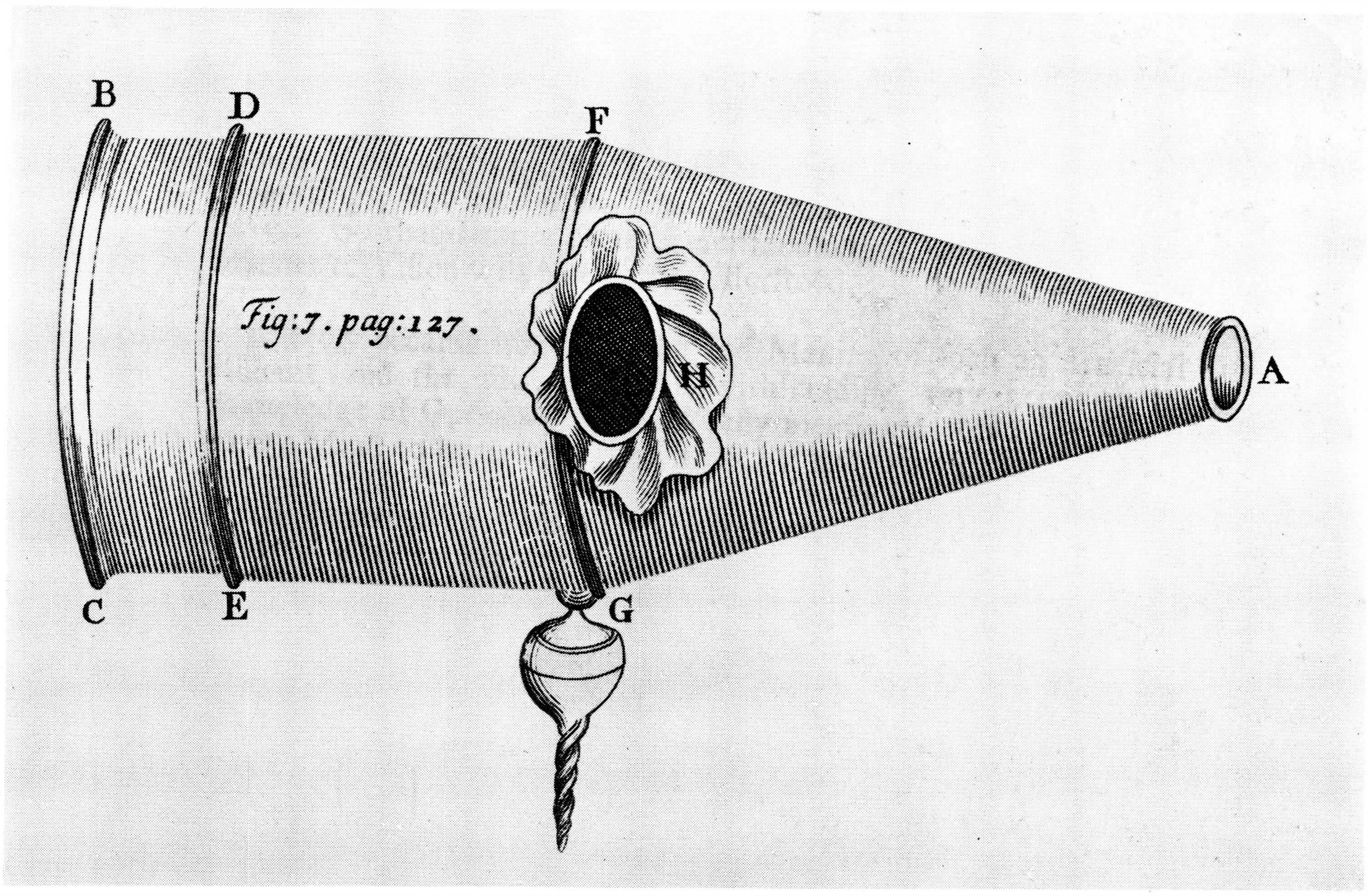
4 ABBÉ NOLLET. Tent camera obscura, 1755

5 ROBERT HOOKE. Portable camera obscura, 1680

6 ROBERT HOOKE. Portable camera obscura, 1694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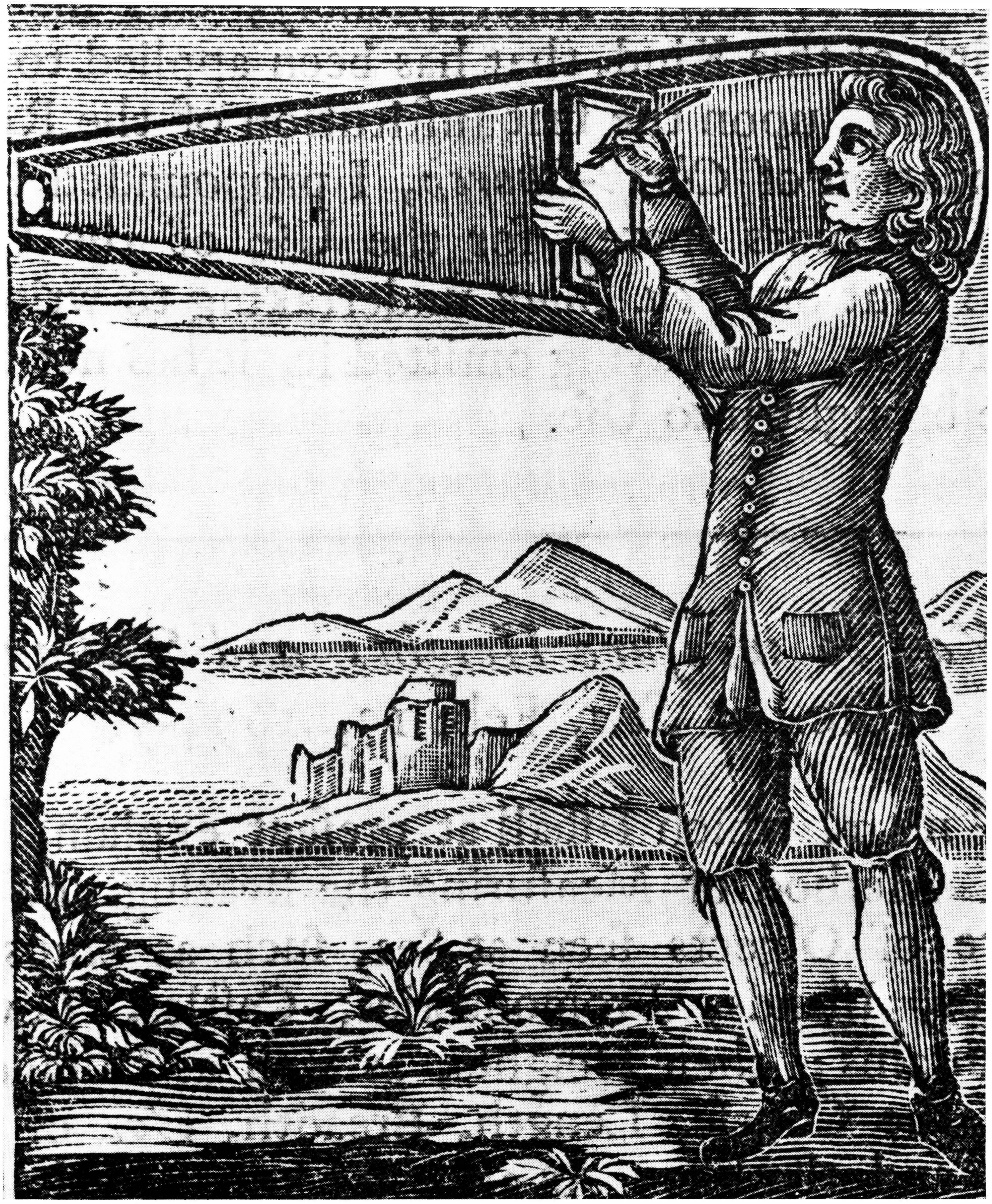

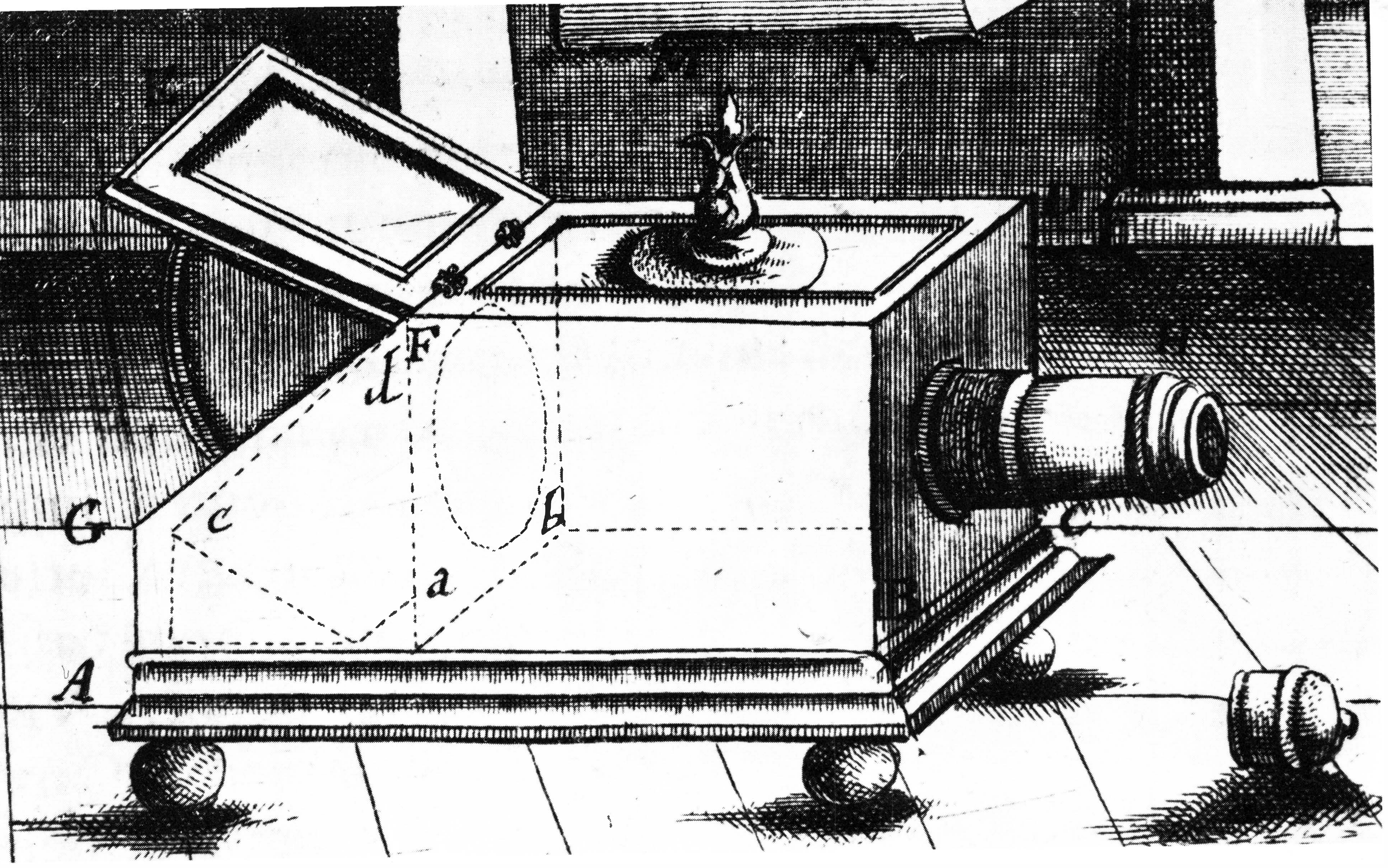
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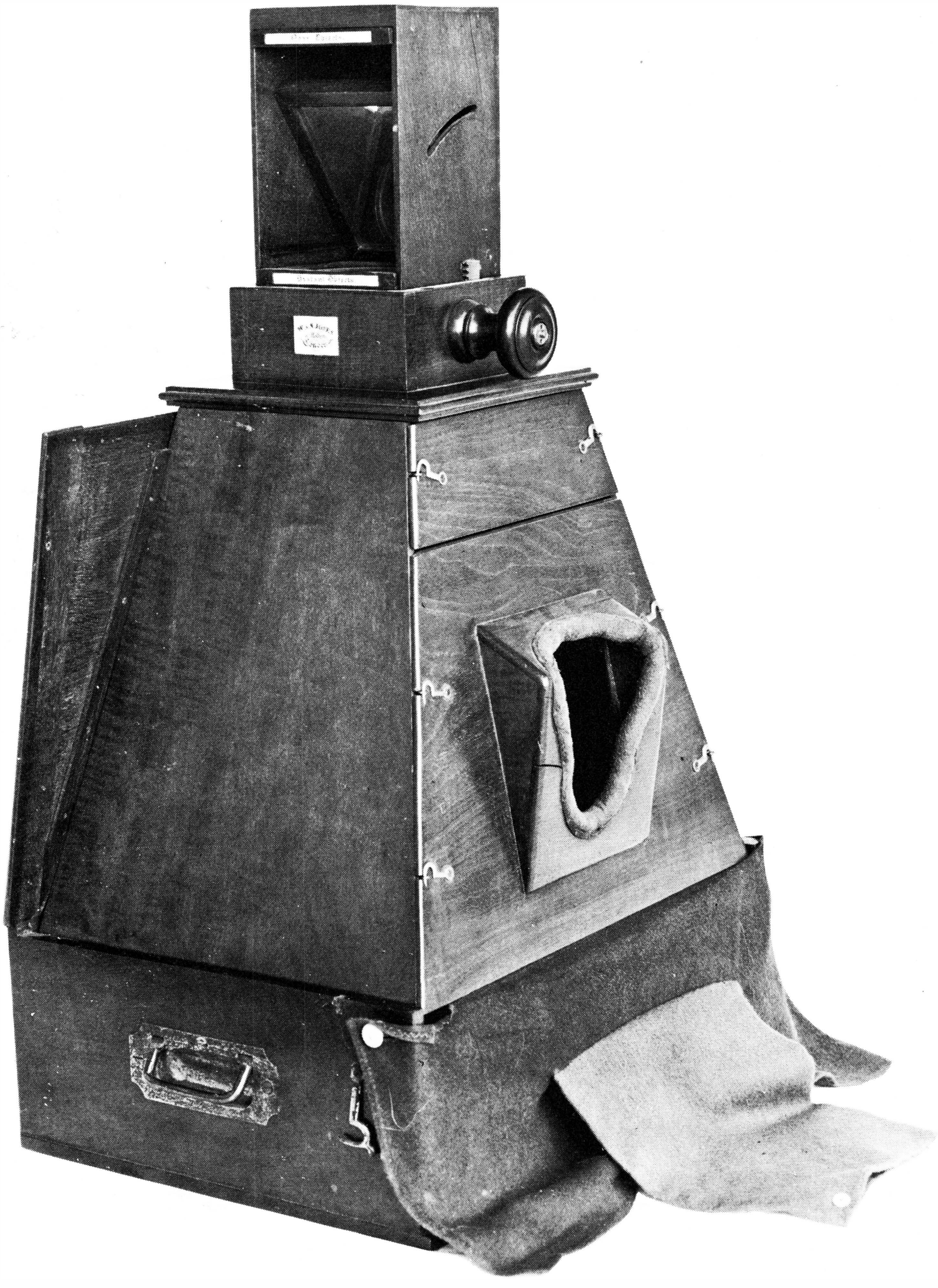
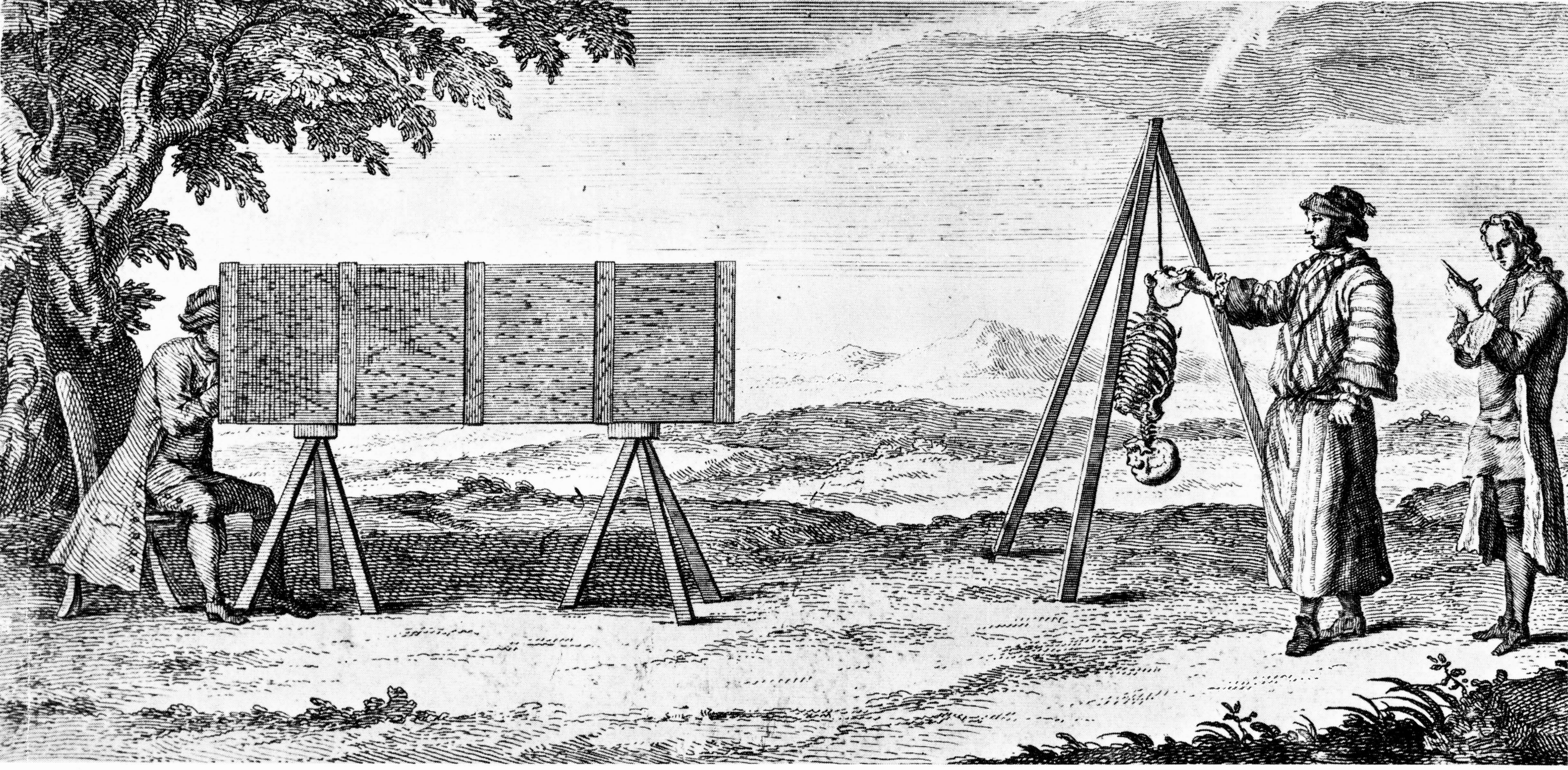
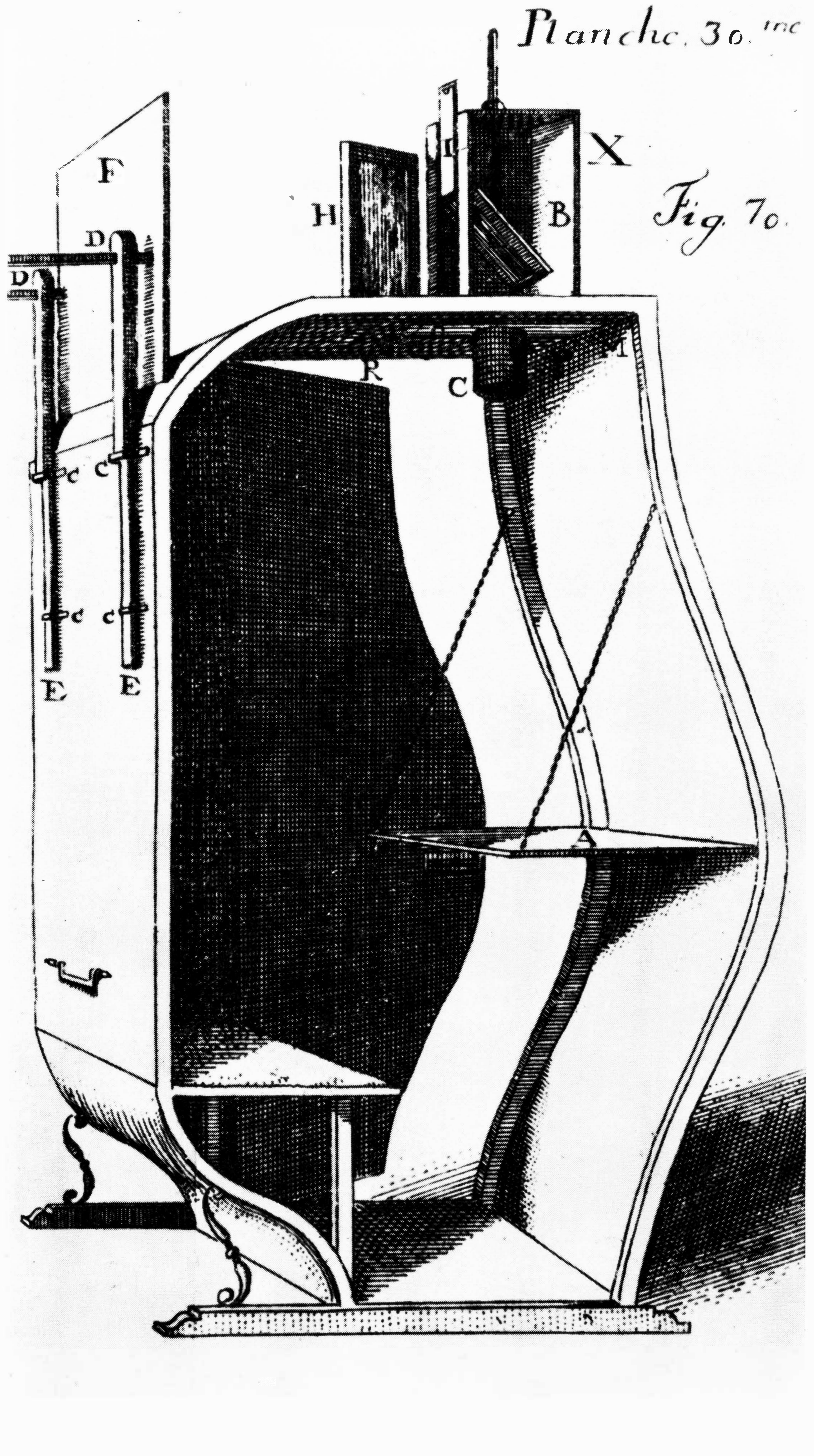




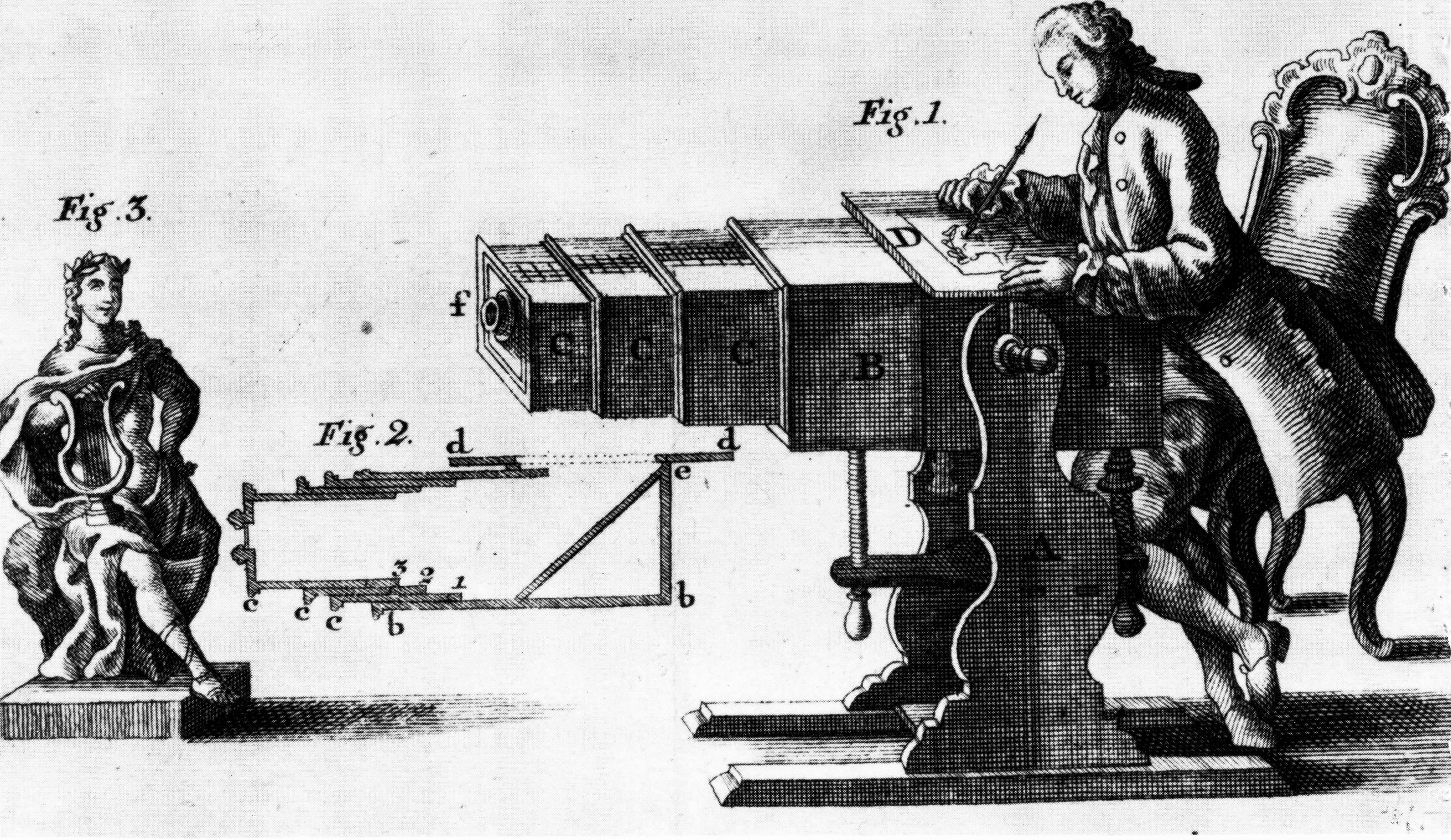


7 JOHANN ZAHN. Reflex box camera obscura, 1685

8 Folding reflex camera obscura, set up for use. Constructed by W. & S. Jones, London, *c.* 1750, the camera has two lenses, one for portraits, the other for views. (A mirror in the periscope reflects the image on to a piece of drawing paper in the bottom of the box. The artist observes the image through a wadded opening in the side, and inserts his hand through a light-tight sleeve.)

9 WILLIAM CHESELDEN. Camera obscura, 1733

10 S'GRAVESANDE. Sedan chair camera obscura, 1711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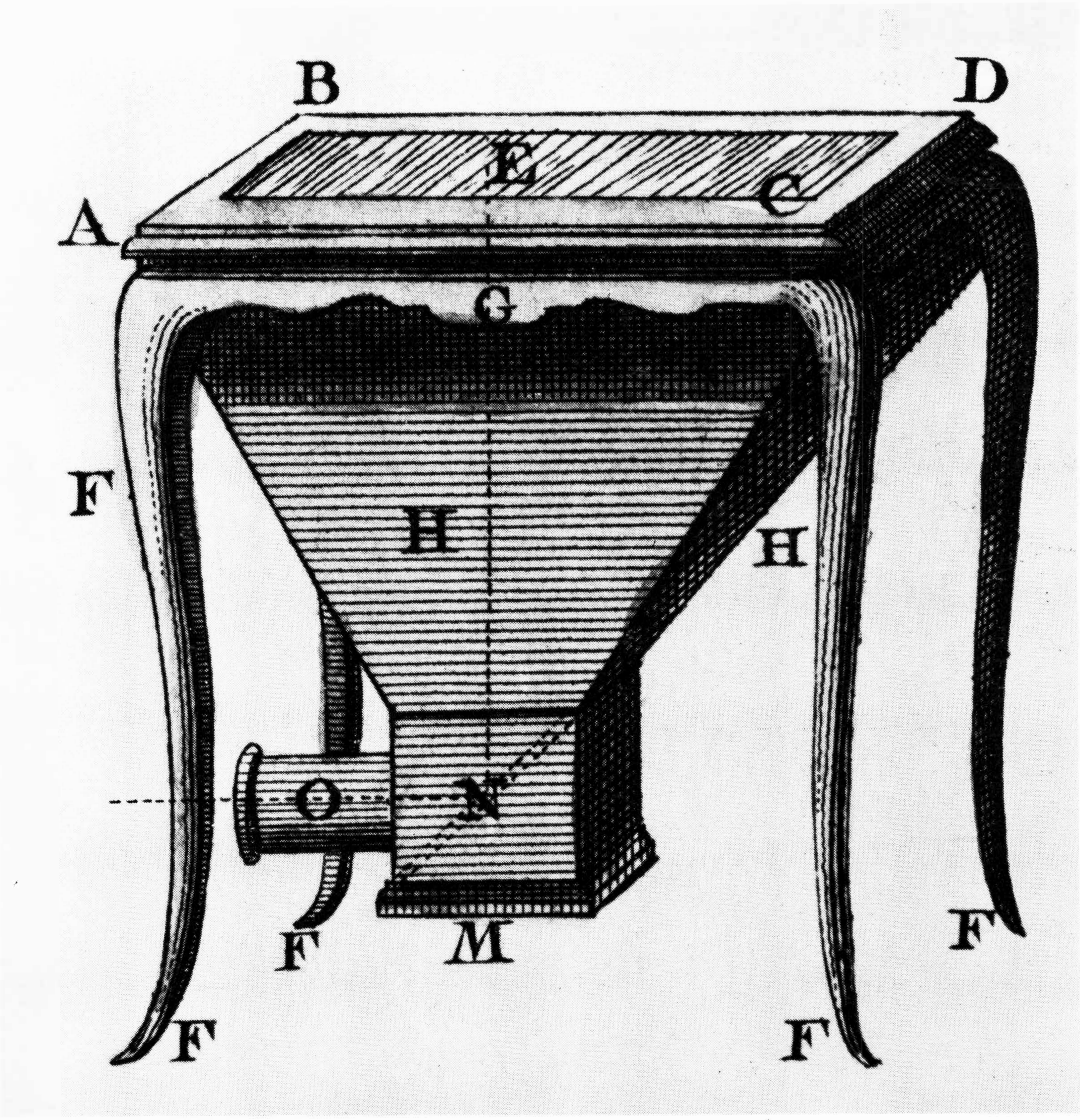
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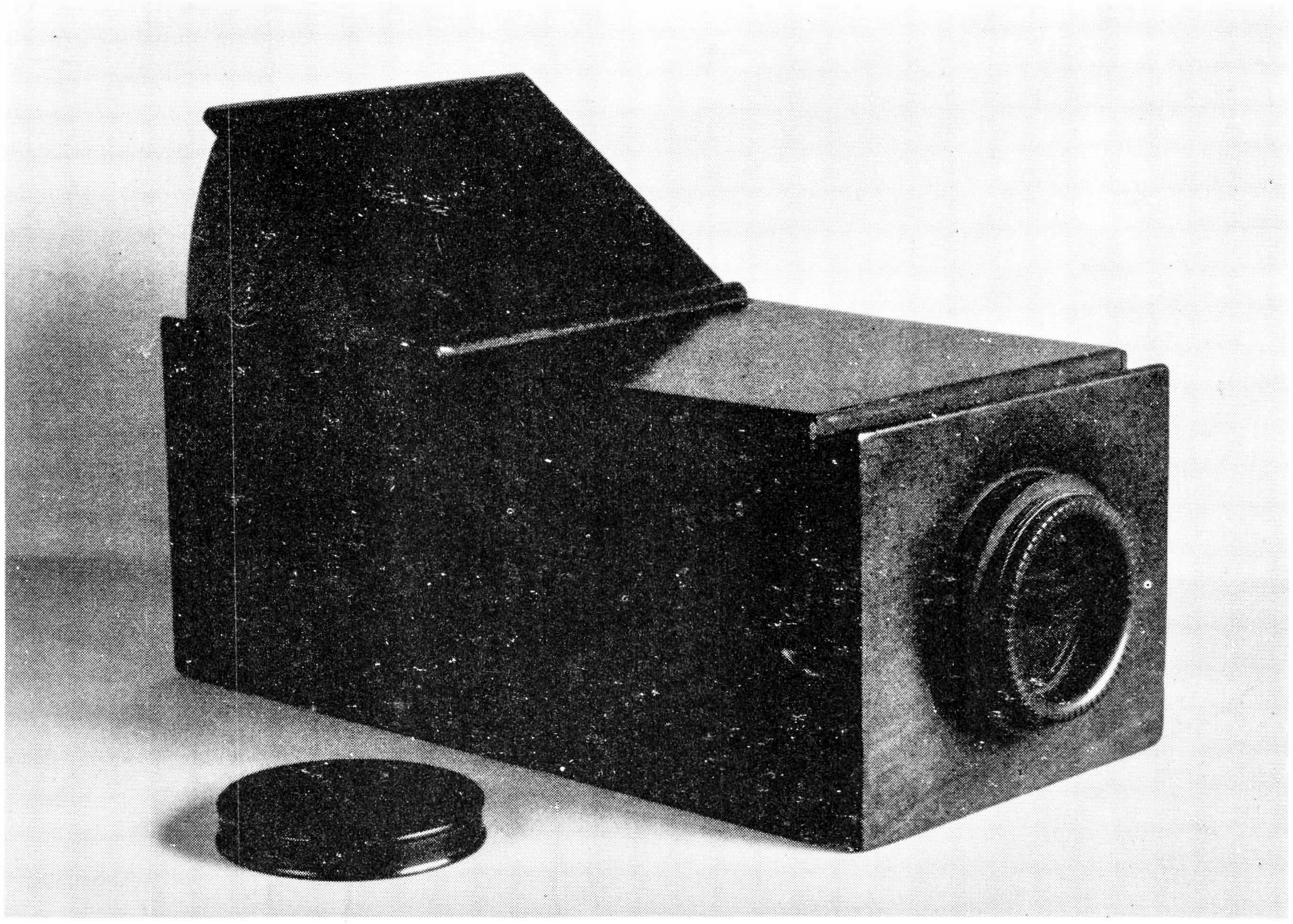
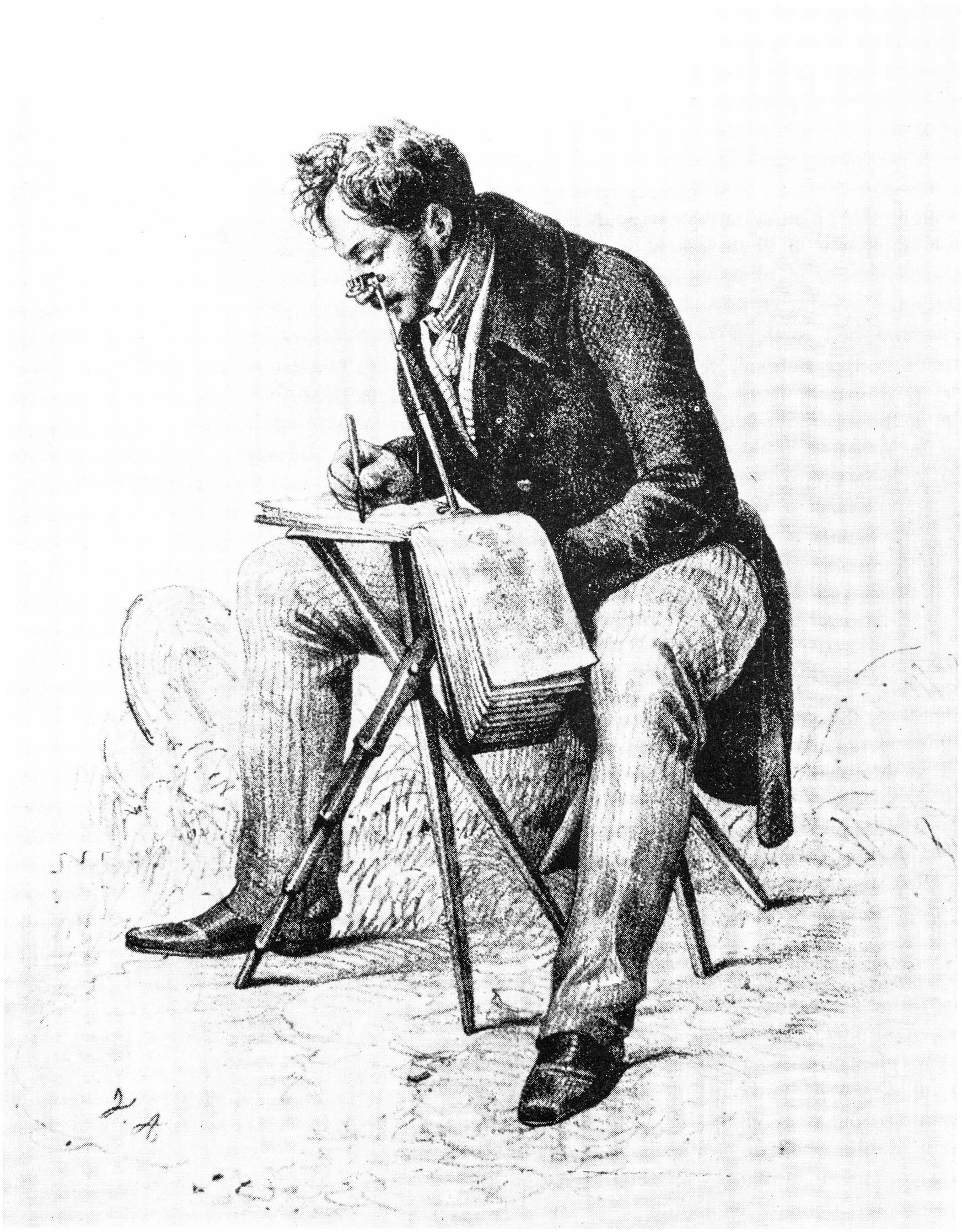
11 GEORG BRANDER. Table camera obscura, 1769

12 GUYOT. Table camera obscura, 1770

13 Portable reflex camera obscura, *c.* 1810, of the type used for drawing by FOX TALBOT and DAGUERRE

14 WOLLASTON's camera lucida, 1807

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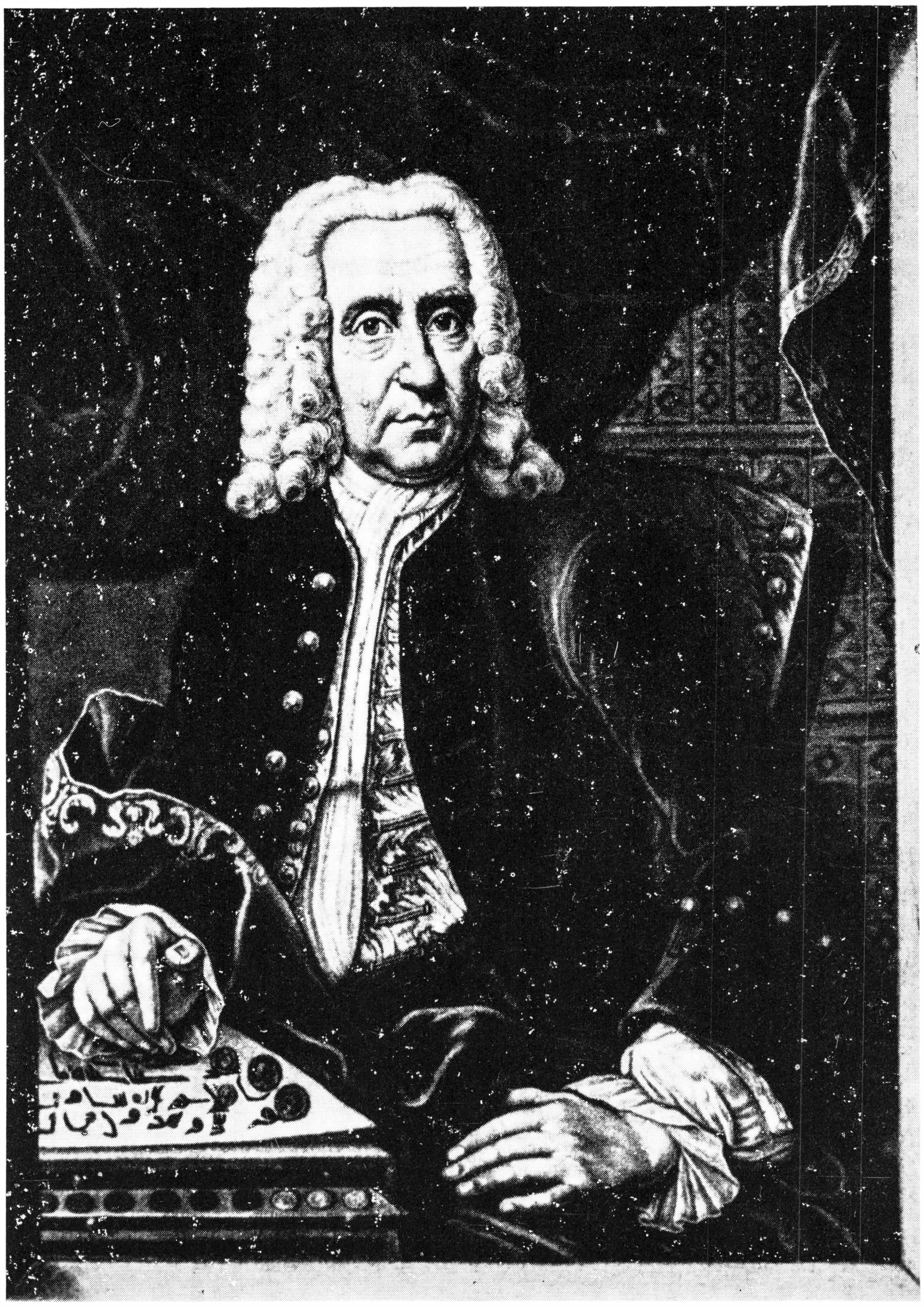
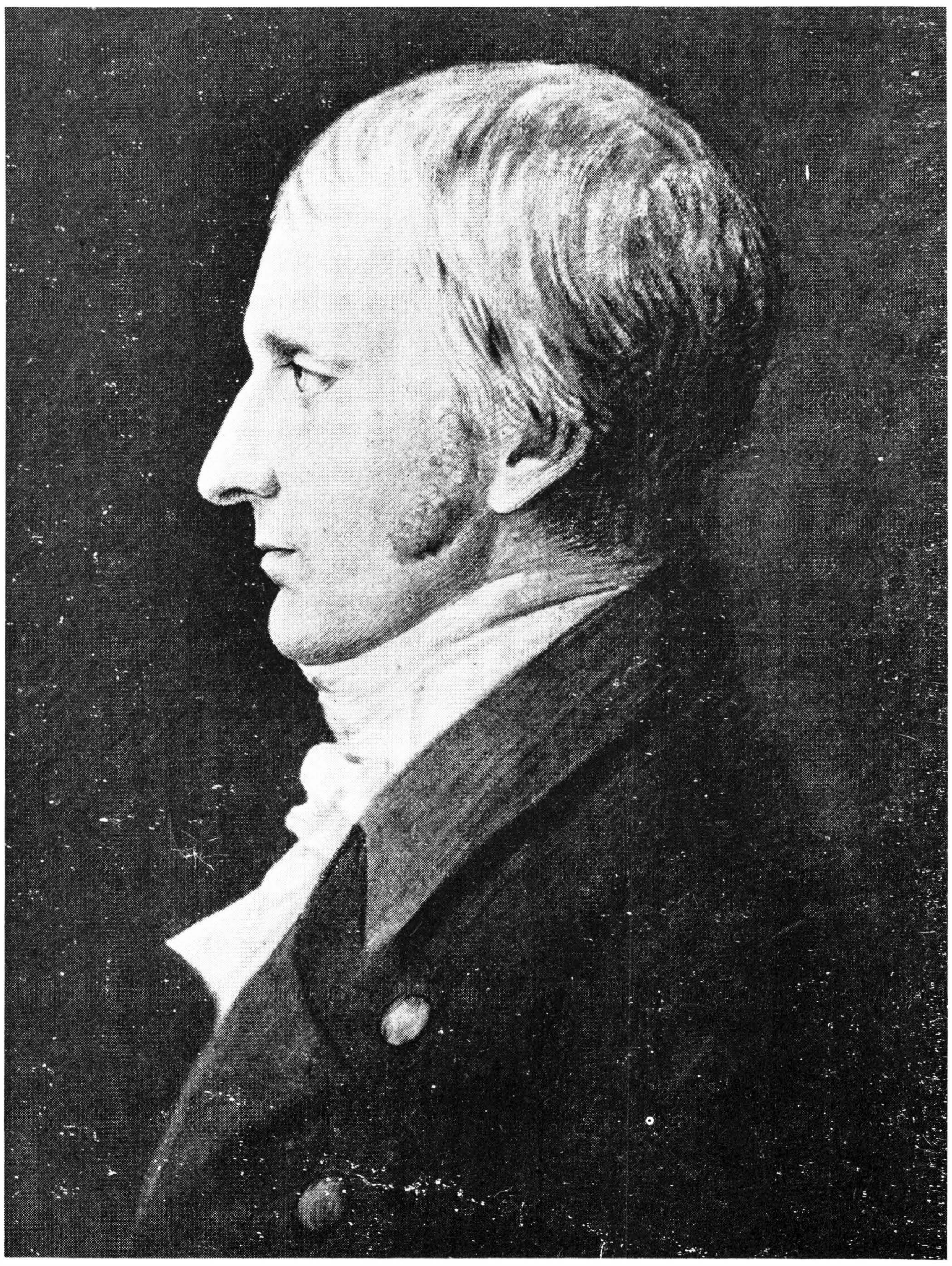




15 JOHANN HEINRICH SCHULZE. Engraving after a painting by Gabriel Spizel, *c.* 1740

16 THOMAS WEDGWOOD. Crayon drawing, *c.* 1800, in the possession of the Wedgwood family

Part II

THE INVENTION OF PHOTOGRAPHY

5 *Heliography*

JOSEPH NICÉPHORE NIÉPCE,[1] the son of a King's Counsellor at Chalon-sur-Saône, Pl 17 was educated at the Oratory at Chalon and lived most of his life on the family estate, Gras, in the village of Saint-Loup-de-Varennes, 4 miles south of Chalon. Even in childhood Niépce had shown a practical and inventive mind, making, with his favourite brother Claude, little working models of machines. While stationed at Cagliari, capital of Sardinia, in 1793, as officers in the army and navy respectively, the brothers made some experiments together to record the images of the camera obscura by chemical means. Beyond this fact, referred to in a letter from Nicéphore to Claude on 16 September 1824, nothing is known.

The family fortune, though diminished by the Revolution, was still adequate to allow them to devote much of their time to scientific pursuits after retiring from military service. In 1807 the Niépce brothers patented the Pyréolophore, an ingenious and surprisingly early engine which actually propelled a boat on the rivers Saône and Seine, and the next twenty years were largely spent in improving and endeavouring to exploit it commercially.

When the craze for the newly invented art of lithography swept France in 1813, it naturally attracted the attention of Niépce. Isidore, Nicéphore's son, made the drawings on stone while his father attended to the chemical side. Not being able to obtain proper lithographic limestone locally, they soon changed over to pewter plates. The following year Isidore joined the army, and Niépce *père*, unable to draw well, placed engravings (made transparent) on plates coated with various light-sensitive varnishes of his own composition and exposed them to sunlight. Though these attempts do not seem to have been crowned with success, Niépce's ideas progressed beyond merely copying drawings to the thought of fixing the very image of nature. Thus lithography led to what Niépce later termed 'heliography'–sun-drawing.

Attempts at true photography, with a camera, started in April 1816. These experiments were actually carried on by Nicéphore Niépce alone, though with constant advice from his brother, who had moved to Paris in March, believing that the metropolis would offer greater chances for the exploitation of the Pyréolophore.

Using three locally made cameras of different sizes, Niépce tried to take the view from his attic workroom at Gras, and throughout the correspondence of the brothers no other subject for camera-pictures is ever mentioned. Not only was this procedure convenient, but it enabled him to gauge progress by comparing results.

Niépce soon succeeded in obtaining the view in the camera obscura on paper sensitized with chloride of silver, though of course–as foreseen by Claude–the lights and shades were reversed. The length of the exposure can only be guessed from the fact that Nicéphore mentioned to his brother on 9 May[2] that the *movement* of the sun did not cause any change in the image: this would imply an exposure of at least an hour.

Less than three weeks later he was able to send Claude some better impressions of the same view, having meanwhile discovered how to sharpen the image by putting a simple cardboard diaphragm in front of the lens. They were partially fixed with nitric acid and could be viewed in daylight for a short while, though Nicéphore warned his brother that the action of the acid would in time bleach the picture.

Niépce was satisfied with the sensitivity of the silver salt employed, but realized that two serious obstacles remained to be overcome: to render the image really permanent, and to get an impression corresponding to the lights and shades of nature (a positive). Tackling the second objective first, Niépce did in fact try to print through one of his negatives, but failed to get an impression; neither did he succeed in fixing the image permanently.

Nevertheless, it is important to remember that Niépce's photographs on paper taken in 1816 were a notable advance on the experiments of Wedgwood, who failed altogether to obtain pictures in the camera obscura, and those he obtained by superposition could only be viewed by candlelight. In addition, in his knowledge of the possibility of making positive prints from negatives, Niépce forestalled Talbot.

Attempts to make *direct* positives with various substances which bleach, instead of darken, under the influence of light led nowhere, for none of them proved light-sensitive enough.

At the same time Niépce also tried, by the decomposition of various acids in light, to obtain the view from his window on metal plates and on stone, and use them as printing-plates. 'This sort of gravure', he wrote on 2 June 1816, 'would be still better than the other [i.e. the paper negatives], because of the facility it would give to multiply the proofs, and of their being unalterable.' Yet after repeated experiments he could only report failure.

During the next few years Niépce tried many different light-sensitive substances, both for direct positives and for printing-plates, but did not progress beyond the stage he had reached within the first couple of months of research. His time was chiefly occupied with improvements to the Pyréolophore, which his brother took to England in August 1817 in the belief that the English were more ready to take up mechanical inventions than the French. From that time on we have only Claude's very guarded replies to Nicéphore's letters to draw upon, and in these he often warns Nicéphore not to describe his experiments too clearly, for fear that the letters might fall into the hands of a third person. For that reason also, he no doubt destroyed Nicéphore's letters.

Niépce's photographic researches took no remarkable turn until July 1822, when he made his first successful and permanent heliographic copy of an engraving, of Pope Pius VII, by means of bitumen of Judea on glass–a totally different principle from photography with silver salts. Niépce had experimented with this asphalt, which is used in engraving and lithography on account of its resistance to etching fluids, for the previous two years. He knew that it is slightly bleached by light, and discovered its more important property of hardening under the influence of light, while the parts protected from it remain soluble and can be washed completely away,[3] leaving a permanent image. Thus he at last arrived at photography by another route, having abandoned his attempts with silver salts owing to his failure to find a fixing agent.

In the bitumen process bitumen of Judea was dissolved in oil of lavender, and a thin layer spread on a glass plate, on which Niépce superimposed an engraving made transparent by oiling. When exposed to light for 2 or 3 hours the bitumen under the white parts of the engraving became hard, whilst that under the dark lines remained soluble and could be washed away with a solvent consisting of oil of lavender and white petroleum (turpentine). The resulting picture was unalterable by light. One can well understand the joy of the two brothers at this turn of events.

> I have read and re-read with admiration [wrote Claude on 19 July 1822] the interesting details you kindly transmitted to me; I thought I saw you, as well as my dear sister [-in-law] and my dear nephew, attentive and following with your eyes the admirable work of light; and *I thought I myself saw a 'point de vue' which I had great pleasure in remembering.* How I desire, my dear fellow, that an experiment so beautiful and interesting for you and for science may have a complete and definite result.

On the strength of the italicized passage the French historian Georges Potonniée was quite positive that Niépce had also succeeded in taking a view from nature (*point de vue*) at the time he copied the engraving of the Pope. This caused him to date the invention of photography 1822, and to have a monument erected to Niépce at Saint-Loup-de-Varennes. But Potonniée was wrong. Claude, remembering the paper views which Nicéphore had sent him six years previously, hoped that he would soon be able to take landscapes as good as the engraving of the Pope–for views from nature were the ultimate goal. Probably Nicéphore had mentioned in his (lost) letter something about this; otherwise why should Claude say 'I thought I myself saw a view which I had great pleasure in remembering'? Even though this sentence is ambiguous and capable of misinterpretation, later letters from Claude make it clear beyond a shadow of doubt that Nicéphore did *not* take a permanent view from nature before 1824 at the earliest. Pl 18

Niépce presented the heliograph of Pius VII to his cousin, General Poncet, who happened to visit Gras at the time. The general was so full of enthusiasm that he carried it with him everywhere to show to his friends, until one day a clumsy admirer dropped and smashed it.

In the following years Niépce copied several engravings in a similar way to that of the Pope, with the difference that he now employed metal–chiefly zinc and pewter–instead of glass, for they were intended to be etched and printed from. Several of these plates, as well as the original oiled engravings, are preserved at the Musée Denon in Chalon-sur-Saône. The most successful heliograph is a copy of an engraving of Cardinal d'Amboise, Minister of Louis XII. In the summer or autumn of 1826 Niépce made two copies of this engraving on pewter, and in February 1827 he sent them, with three other heliographs, to the Parisian engraver Lemaître, who re-etched them with stronger acid and pulled one print from each.[4] No handwork was done on them. Of these two plates, one was brought by Niépce to London in September 1827, with two proofs. This plate and one print are in the Science Museum, London; the other print is in the Gernsheim Collection. The second plate of the Cardinal is in the Museum at Chalon, which also possesses a third, rather poor, plate–poor because it is over-etched, and the prints pulled from it are in consequence far too contrasty compared with the two other proofs. There exists no documentary evidence about this third plate; it might have been over-etched by Niépce himself in a first trial before entrusting the other two to the professional skill of Lemaître; but it is more likely that Jules Chevrier, curator of the Chalon Museum, tampered with it in 1864 when he had several prints pulled, of which one is at the Museum in Pl 19

Chalon, another in the collection of the Société Française de Photographie, and a third at the Conservatoire des Arts et Métiers. That Chevrier had at least the intention of re-etching another of Niépce's plates, showing Christ bearing the Cross, is borne out by a remark of Fouque.[5] Further copies of the one or the other Cardinal plate at Chalon were printed by Blanquart-Evrard in 1869 and used in the second edition of his book *La Photographie, ses origines, ses progrès, ses transformations*, published in Lille, 1870.

In the same year in which he produced the photo-engraving of Cardinal d'Amboise, Niépce succeeded for the first time in fixing permanently the image from nature. The world's first photograph, now in the Gernsheim Collection, is also on Pl 21 a pewter plate, size 8 in. × 6½ in. The subject exactly fits the description of the view from his window which Nicéphore gave in a letter to Claude on 28 May 1816, when he was experimenting with photography on paper. On the left is what the brothers called the pigeon-house (an upper loft in the Niépce family house); to the right of it is a pear-tree with a patch of sky showing through an opening in the branches; in the centre, the slanting roof of the barn. The long building behind it is the bakehouse, with chimney, and on the right is another wing of the house (as it was at the time). Owing to the small light-sensitivity of bitumen of Judea, the exposure in the camera lasted about 8 hours on a summer day. The length of exposure for pictures in the camera is not only confirmed by Niépce's son but is evident in the picture itself, in which the sun seems to be shining on both sides of the courtyard!

As in the photo-engravings, the latent image was rendered visible by washing the plate with a mixture of oil of lavender and white petroleum, which dissolved away the parts of the bitumen which had not been hardened by light. The result was a direct positive picture in which the lights were represented by bitumen and the shades by bare metal. After rinsing and drying the picture was unalterable.

There is no absolute agreement amongst historians as to the year in which Niépce first succeeded in taking a permanent view from nature, though most (including his son Isidore) favour 1824.[6] Indeed, one of Claude Niépce's letters also supports the view that Nicéphore took a partially successful photograph from nature (on stone, copper, or glass) in the summer of 1824; yet apparently the intensity of the image was not satisfactory, for on 3 September 1824 Claude, in congratulating his brother on his good results, remarks

> They are such as you could have wished, since they confirm your hopes to have the means to engrave [make pictures] on stone, on copper, and on glass. . . . One can say that you have made giant's strides since your last attempts at views from nature, since you have been able to obtain certain details which prove the possibility of succeeding in totality. The difficulty that remains to be conquered is small. . . . But it would be possible, I presume, to augment the intensity of the image by receiving it reflected from a mirror which would then communicate it to the camera obscura. . . . The engraving of views from nature is still more magical than the other [i.e. copying engravings by superposition] which is far from being only a knick-knack, as you like to call it; but it is one of the most useful and most brilliant discoveries of the century, and I am sure, and I desire with all my heart, that it will be infinitely productive.

The reader should be warned that the terms used by the Niépce brothers are confusing and at times even misleading. Just as in England photographs in the early days were referred to as 'drawings' or 'sketches', the nomenclature of the older arts, especially of engraving, was drawn upon by the Niépces. They write of 'pulling proofs' when they mean taking photographs on paper. 'Graver' and 'gravure' sometimes refer actually to etching metal plates, but often simply mean to make a picture on any substance. Nicéphore *never* succeeded in making an engraving-plate of a view from nature, as has been claimed by Georges Besson and Professor Stenger.[7] The original impression on the plate—even after 8 hours' exposure—was far too faint for this step ever to be considered.

The view which Niépce called his *first successful* experiment from nature must have been taken in 1826 and not 1824, for two reasons.

1. The metal it is made on is pewter. Having experimented with copper and zinc in 1825, Niépce tried pewter in 1826. On 26 May he wrote to his son, 'I have sent for new pewter plates; this metal is more suitable to my object, principally for views from nature, because, reflecting the light more, the image appears much clearer. I congratulate myself, therefore, on this happy inspiration.'[8]

2. In January of that year Niépce, who for ten years had been working with makeshift cameras, acquired his first professionally made camera obscura from the well-known opticians Charles and Vincent Chevalier of Paris. This was fitted with a meniscus prism, which would correct the lateral transposition of the image. This was of great importance, for when the metal plate itself was intended to be the picture—as in the case of a view from nature which could not be etched satisfactorily—by means of this prism the direct positive view obtained was not laterally reversed. Though Niépce's estate, Gras, was altered to some extent by later owners, the tower (pigeon-house) on the left of our photograph still stands, and is in fact *on the left* when looking out of the window of Niépce's attic workroom, a proof that a prism was used when taking the photograph. Pl 20

These two facts make it quite certain that the view cannot have been taken before 1826: it might even have been taken in the spring or summer of 1827.

Having been shown over Niépce's house in September 1952, we may also mention that the two ridges of brickwork on the left of the picture can still be clearly seen, though the roof of the tower has been made higher, and the barn and the building on the right pulled down, opening up the view over the park. Comparing the actual position of the tower with the impression of considerable distance conveyed by the photograph, it is evident that the optical system used produced the same perspective distortion as a wide-angle lens. Barrel-shaped curvilinear distortion is also noticeable.

Taking 1826 as the date of this photograph, it is nine years earlier than Talbot's first paper negative (1835) showing the lattice window of his library, and eleven years prior to Daguerre's first successful result, a still-life taken in 1837.

The Niépce photograph, which had been the object of our researches for several years, was rediscovered in England through our efforts in January 1952 and subsequently presented to our Collection. It is the world's earliest, and the inventor's sole surviving, photograph from nature.

How did this photograph come to England? In September 1827 Nicéphore Niépce and his wife came to visit Claude, who was dangerously ill at Kew. They lodged nearby at the Coach and Horses Inn kept by a Mr and Mrs Cussell, of whom Nicéphore wrote to Isidore on 5 November 1827, 'Our hosts are very nice people, but the meals are bad, the beds are worse, and it is terribly expensive'.

While staying at Kew Niépce came into contact with Francis Bauer, the well-known botanical draughtsman at the Royal Botanical Gardens, Kew. On learning of Niépce's photographic experiments Bauer at once recognized the importance of the invention, and persuaded Niépce to address a memoir on the subject to the Royal Society, of which he was a Fellow (he was never *Secretary* as is often mistakenly

Pl 25 claimed). This document in Niépce's handwriting, which also came to light again in January 1952 and is now in the Gernsheim Collection, is entitled 'Notice sur l'héliographie', dated 'Kew, le 8 Décembre 1827' and signed N. Niépce. It was accompanied by several specimens of heliography which Niépce had hastily sent for from France.[9] These, with the single exception of the view reproduced in Plate 21, were reproductions of engravings. The specimens were all referred to in the opening paragraph of his communication as 'The first results of my long researches on the manner of fixing the image of objects by the action of light', and Niépce ended with the formal declaration: 'that I am the inventor of this discovery, that I have not confided the secret to anyone, and that this is the first time that I have given it publicity. I congratulate myself on making it known in a country as justly renowned for its taste for the culture of the Arts, as for the welcome and the protection which talent receives there.'

But in spite of these flattering remarks and Niépce's personal contact with Dr W. H. Wollaston, one of the Vice-Presidents of the Royal Society, the memoir and specimens were never formally communicated to the Society, because the cautious Niépce had only alluded in general terms to his invention. As he was unwilling to disclose the secret of his process, the Royal Society could not take cognizance of it, and there is no record at all of the matter in the Council minutes. This decision seems inconsistent with the fact that Talbot in his communication 'On the Art of Photogenic Drawing' on 31 January 1839 gave no details of his process and supplied these only in his papers of 21 February and 21 March.

According to a plan which Niépce had disclosed to Bauer before preparing the memoir,[10] Niépce next tried to interest George IV through the good offices of William Townsend Aiton, Director of the Royal Botanical Gardens, Kew. Failing to find royal patronage, he then approached the Society of Arts, and encountered the same indifference. What course photography would have taken had Niépce's invention been made public at this period forms a fascinating speculation. Publication would no doubt have at once reminded Sir Humphry Davy, President of the Royal Society in that very year, of his own and Wedgwood's experiments. (Sir) John Herschel, F.R.S., would have come to hear of these, as well as of Niépce's, experiments, and he could have provided Davy with the necessary fixing agent, having in 1819 discovered the property of hyposulphite of soda to dissolve the various silver salts. This would in all probability have led to photography on paper twelve years earlier, and Talbot would then never have been heard of in this connection. Niépce would certainly not have entered into partnership with Daguerre, with the result that the beautiful but short-lived daguerreotype process would never have seen the light of day. However, such speculations are idle, for the Royal Society, the King, and the Society of Arts were clearly not interested in Niépce's invention.

Disappointed at this lack of interest in the very country which he had thought would welcome and protect new talent, Niépce returned to France towards the end of January 1828. Before finally turning his back on England, however, he rewarded Francis Bauer's assistance by presenting him with the manuscript of his communication to the Royal Society, the photograph from nature, three heliographic reproductions of engravings, two paper prints of Cardinal d'Amboise, and one of a landscape
Pl 23 after Claude Lorrain. Bauer labelled all these specimens 'L'Héliographie. Les premiers résultats obtenus spontanément par l'action de la lumière' and with the date of their presentation to him, 1827. The view from nature bears the additional remark 'Monsieur Niépce's first successful experiment of fixing permanently the image from nature'.

For the subsequent history of these photographic *incunabula*, and of another plate which Niépce presented to his landlord, the reader is referred to our detailed accounts in *The Photographic Journal*[11] in which also the full French text of Niépce's memoir will be found. It is surprising that none of the French historians had any knowledge of the existence of these Niépce relics in England. More astonishing still is the fact that one of them, the photograph from nature, which disappeared in 1898, was always spoken of, and even exhibited as 'a view of *Kew*', until we drew attention to the fallacy twenty months before the picture came to light again in a trunk which had been in storage since 1917. The world's first photograph can therefore truly be said to have been rediscovered in more than one sense.

While in Paris on the way home, Niépce had several meetings with Daguerre, whose acquaintance he had made on the outward journey. Their first contact dates from January 1826–the time when Niépce ordered a camera obscura from the Chevaliers. Niépce had asked his cousin, who was going to Paris, to buy the instrument for him, and in his zeal to make sure that he was getting the best possible Colonel Niépce explained the purpose for which it was required, and when the Chevaliers seemed somewhat incredulous even showed them a specimen of heliography. Daguerre, who had also been trying for at least a year to fix the images of the camera obscura by means of silver chloride paper, and phosphorus, happened soon after to visit the Chevaliers, with whom he was friendly, and they advised him to write at once to Niépce, who had already achieved such remarkable results. Niépce received Daguerre's overtures with great reserve, and it was sixteen months before he succumbed to his persistence and sent him a heliographic printing-plate representing the Holy Family, and a proof from it, in exchange for a *dessin fumé* which Daguerre had sent him. In all this, the two inventors were very secretive about their methods; in fact Daguerre's bait had not been produced by photographic means at all, but Niépce was unaware of this.

For a few months after his return from England Niépce was much occupied in putting his brother's affairs in order, for Claude had died about a fortnight after Nicéphore left Kew. The Pyréolophore, on which thirty years' work had been lavished, and as a consequence of which the Niépce family had got hopelessly into debt, was now abandoned. Niépce did not resume his photographic experiments until May 1828, when he tried two new lenses, an achromatic one, and Wollaston's periscopic meniscus lens, both of which Chevalier made for him. Though Wollaston's periscopic camera obscura had been introduced in England as early as 1812,[12] the optical arrangement was still a novelty in France, and only came to be generally introduced by Chevalier in 1829.

Fully aware that the camera view he had taken to London was still far from what he desired, Niépce ascribed its imperfections, and in particular the very long exposure time, to the various lenses he had so far been using. On 20 August 1828 he wrote to Lemaître,

> I have now entirely given up copying engravings, and restrict myself to views taken with the perfected camera obscura of Wollaston. The periscopic lenses have given results much superior to those which I obtained up to the present with ordinary lenses, and even with the meniscus prism of V. Chevalier. My sole object having become to copy nature with the greatest fidelity, it is to that which I attach myself exclusively, for only when I have succeeded with this, can I seriously occupy myself with the different modes of application of which my discovery is capable.

Niépce still hoped that he might eventually be able to turn his camera views into printing-plates, and following the advice of his engraver, who had suggested copper as the most suitable metal for printing-plates, he gave up pewter, which was too soft for engraving. From now on he made heliographs on silver-plated sheets of metal (*doublé d'argent*) and silvered copper plates (*argent plaqué*) thus combining brightness of surface–which he needed for views from nature–with hardness of metal, in case any of them should turn out well enough to be etched.

In 1829 Niépce discovered that the contrast of the picture could be increased by blackening the bare parts of the silvered plate with vapour of iodine in an iodizing-box. The bitumen forming the light parts of the image, which remained unaffected by the iodine vapour, was then removed with alcohol and the resulting photograph was made up of shiny metallic silver and dark silver iodide; there was no bitumen at all. Niépce at once repeated the view from his window by this new process and sent it to Daguerre at the beginning of October 1829. This heliograph has never come to light, but we know Daguerre's and Lemaître's reaction to it. They praised the detail (which is certainly lacking in the world's first photograph) but criticized the tone values and, above all, were disturbed by the appearance of sunlight on parallel opposite sides of the court-yard. In other words, the exposure was as long as it had been in 1826, and Wollaston's periscopic camera obscura did not prove to be the solution Niépce had hoped for.

Still clinging to the idea that the exposure could only be shortened by a better lens, instead of dispensing with a diaphragm or searching for a more light-sensitive substance, Niépce wrote to Lemaître on 25 October in reply to his and Daguerre's criticisms: 'In order to obtain success the exposure must be short, i.e. the image must be sharp and brilliant. For this, a camera as perfect as M. Daguerre's [of which Lemaître had written in praise] is necessary, and without it I fear I shall be only partly successful.' Later events proved that Lemaître's high opinion of Daguerre's camera was unfounded.

Failing to find a solution to the problem, Niépce felt that the time had come to publish his process as it was, and began to write a handbook *On Heliography*. As soon as Daguerre heard of it he advised Niépce to postpone publication, reasoning that 'There should be found some way of getting a large profit out of it before publication, apart from the honour the invention will do you'.

Impoverished as he was, Niépce thought this a sensible suggestion, and invited Daguerre to collaborate with him in bringing heliography to perfection, and on 14 December 1829 a contract for ten years' partnership was signed at Chalon. In this they agreed to found the firm of Niépce-Daguerre, with the object of perfecting and exploiting Niépce's invention, the profits to be shared equally. The partnership was somewhat unequal from the start: Niépce had to supply Daguerre with complete details of his process, while Daguerre's contribution consisted merely in 'a new combination of camera obscura, his talents, and his industry'. Evidently Daguerre had made no progress whatever with his photographic experiments so far, and he had nothing to show or to contribute. The novel camera, moreover, turned out to be the periscopic camera obscura of Wollaston, with which Niépce had been working since the previous year, the only difference being an achromatic lens with which Chevalier had improved the camera for Daguerre.

In the exposé of his process which Niépce prepared for Daguerre, he refers to two views from nature made on glass by means of the camera, giving 'results which, though very imperfect, appear deserving of notice here, because this species of application may be brought more easily to perfection and become in the sequel a most interesting department of heliography'. How far-seeing this notion was, the subsequent history of photography was to prove.

Pl 24 Only one of these glass photographs is known. It represents a table laid for a meal (as a change from the much-repeated view from his window) and has often been mistakenly published – with wrong date attibutions, usually 1822 or 1823 – as Niépce's first photograph from nature. In his communication to the Royal Society Niépce stated that Daguerre had advised him not to neglect the application of his process on glass, a material which we know Niépce had already used for his first successful engraving, of Pius VII, in 1822. However, there is no documentary evidence of any engravings or views from nature executed on *glass* between 1822 and January 1829, when Niépce ordered a supply of glass plates. Niépce's correspondence with his brother contains no reference to any still-life subject; the only camera photographs mentioned are of the view at Gras. From the fact that Daguerre's own (later) experimental pictures were all of still-life subjects, Potonniée inferred that this one was probably made under Daguerre's influence some time after the signing of the partnership agreement. This is quite possible, but at the same time we should bear in mind that two glass pictures are mentioned *before* the agreement was signed.

Nothing remains of this still-life but a rather poor half-tone reproduction made in 1891. Unfortunately the original glass picture, like that of Pius VII, was broken – and in the most extraordinary circumstances. In 1909 it was lent by the Société Française de Photographie to Peignot, a professor at the Conservatoire des Arts et Métiers, for scientific tests. The purpose of these is rather mysterious, since Niépce had fully described his process; nor shall we ever know the professor's findings, for Peignot, seized one day with a fit of mania, smashed everything in his laboratory, including this photographic *incunabulum*.[13] Thus, all but one of Niépce's few attempts at a photograph from nature have been lost. The inventor died in 1833 without ever seeing his process brought to perfection, and his widow and son were obliged to sell their entire property. A life's work and a great deal of money had been lavished on an idea.

Twenty years after Niépce's death his cousin Abel Niépce de Saint-Victor, in collaboration with Lemaître, took up the process again, and by various modifications speeded up the exposure to a few minutes for laid-on copies, and 10–15 minutes in the case of views in the camera.[14] Two years later he fulfilled Nicéphore Niépce's ambition to take a photograph in the camera, etch it, and pull paper prints from it.[15] Thus Nicéphore Niépce's process *was* capable of improvement and practical application, though Daguerre's experiments had led him in a different direction.

Niépce's cameras. As mentioned on page 55, Niépce's earliest experiments were made with three locally made cameras. The first we hear of on 12 April 1816. It was a 6-in. square box with a lens-tube adjustable for focusing. Almost immediately he broke the lens, and then made a tiny camera out of Isidore's jewel-box (approx. 3·6 cm. × 4 cm.) and fitted it with one of the lenses from his grandfather's solar microscope. This gave a sharp image just under 3 cm. in diameter. On 9 May Niépce mentions having made another camera of intermediate size between the small and the large one, and again using one of the microscope lenses. These cameras no longer exist. We have also previously referred to Niépce's first professionally made camera, bought from Chevalier in January 1826, which does not appear to have survived, either, nor have any of the various lenses mentioned.

In the Musée Denon at Chalon-sur-Saône are preserved several cameras which are not dated but were probably used by Niépce between 1826 and his death in 1833. They are fairly large, being made to take 6$\frac{1}{2}$ in. × 8 in. plates, and are the earliest existing photographic cameras. Some of these are of particular interest on account of certain features which were to become essential in camera design.

Pl 22 One camera, claimed to be the oldest, consists of two boxes (like the later Daguerre cameras) 30 cm. square when closed, the box with the plate-holder sliding within that holding the lens. This camera has no built-in diaphragm. In another camera of the same size, the lens-panel and the ground-glass are connected by a locally-made accordion-like square bellows–the prototype of all bellows cameras to this day. One slightly larger camera, 31·5 cm. × 35·5 cm. × 40·5 cm., is fitted with a variable metal-leaf iris diaphragm[16] to sharpen the image. The bellows and iris diaphragm are novel features which Daguerre's camera lacked, and were very much ahead of their time.

In order to observe the progress of the image from time to time during the very long exposure, Niépce had some of the camera boxes pierced with spy-holes which could be plugged up. The same device was also incorporated in Fox Talbot's cameras from 1839 onward, but he may have heard of it from Chevalier, who supplied him with cameras at that period.

It would be tedious to give a description of all the equipment at the Musée Denon, but we should still single out the first metal camera. It is made of zinc, is 65 cm. long × 36 cm. high × 36 cm. wide, and bears an old label, 'Chambre noire envoyée par Daguerre à J. N. Niépce'. This, however, is not the periscope camera obscura supplied by Daguerre under the partnership agreement. The camera consists of a single box; the back with the plate-holder is fixed, but the distance of the lens-panel, which lies behind the diaphragm, could be varied by means of a handle attached to the board outside. This camera is also fitted with an iris diaphragm which can be altered by means of a lever. If the label, which was probably affixed to the camera by its donor, the Marquis d'Ivry, is correct, Niépce must have added the diaphragm, for Daguerre obtained his cameras from Chevalier, and the latter stated at a meeting of the Société Française de Photographie on 28 May 1858 that he first employed an iris diaphragm in 1840. We mention this only because the camera as labelled might create the impression that Daguerre gave Niépce the idea of the diaphragm, whereas the reverse is the case.

6 *The daguerreotype*

Though to Niépce goes the credit of having devised the first photographic process, and of having invented the earliest photo-engraving method, it was left to his partner Daguerre to make photography practicable as distinct from possible. Indeed, for twelve years the daguerreotype remained supreme in the photographic studios of the world.

LOUIS JACQUES MANDÉ DAGUERRE was born on 18 November 1787 at Cormeilles-en-Parisis. His childhood was spent at Orleans, where his father was employed as a clerk on the royal estate. Showing talent for drawing, the boy was apprenticed to an architect at the age of thirteen, and three years later became a pupil of Degotti, scene-painter at the Paris Opera. Later he made himself independent and designed the *décor* for the productions of several Paris theatres. He also collaborated with Prévost on a number of large panoramas–a kind of show which enjoyed immense popularity in the last decade of the eighteenth and first half of the nineteenth centuries, having been invented in 1787 by Robert Barker, an Irish artist working in Edinburgh. Pl 28

In 1822 Daguerre associated himself with the painter Charles Bouton (an assistant of Prévost) in a new venture, the Diorama, a picture show with changing light effects which aroused astonishment and admiration by its perfect illusion of reality. The whole of Paris was in ecstasy. One mystified eye-witness of 'A Midnight Mass at St. Etienne-du-Mont'–one of the most famous of Daguerre's tableaux–gives a vivid description of the kind of show that held the spectators in the darkened theatre spellbound and brought fame to the inventor.

> At first, it is daylight; we see the nave with its chairs; little by little the light wanes and the candles are lighted. At the back of the choir, the church is illuminated and the congregation arriving, take their places in front of the chairs, not suddenly, as if the scenes were shifted, but gradually, quickly enough to astonish one, yet without causing too much surprise. The midnight mass begins. In this reverent stillness the organ peals out from under the distant vaults. Then the daylight slowly returns, the congregation disperses, the candles are extinguished and the church with its chairs appears as at the beginning. This was magic.[1]

The 'magic' was achieved by fairly simple though very ingenious means. The picture was painted on both sides of a transparent screen, and the change of effect was produced by controlling the windows and skylights so that sometimes the picture was seen by light shining on the front of the screen, at others by transmitted light from behind, or by a combination of both. In this particular tableau the empty church was painted on the front of the screen in transparent colours, and on the verso in opaque colours the figures of people. In reflected light the empty church alone was visible; the front of the screen was then gradually darkened by closing the skylights, and on opening those at the back the altar lamp and 'candles' were lit up and the congregation seemed gradually to fill the church.

The Diorama pictures measured about 15 yds high by 23 yds wide and were at a distance of 14 yds from the audience.

In the following years Daguerre and Bouton went even farther in heightening the cunning illusion of reality by adding actual objects in the foreground. A view of Mont Blanc, for example, contained a genuine chalet, real fir-trees, and live goats, and was accompanied by the sound of cowbells, alp-horns, and folk-songs. How perfect the counterfeit of nature must have been is amusingly illustrated by an anecdote. Louis-Philippe was asked at a command performance by his youngest son, 'Papa, is the goat real?' 'I don't know, my boy', replied the king, 'you will have to ask M. Daguerre himself.'

Encouraged by the immediate success of the Paris Diorama, Daguerre and Bouton started another at Regent's Park, London, in 1823. The building, erected from the designs of Morgan and Pugin at Park Square East was opened on 29 September of that year, and the dioramic transformations were received with no less enthusiasm than in Paris.[2] One of the tableaux shown in Paris and London in 1824 and 1825 respectively was a moonlit view of the ruins of Holyrood Chapel, Edinburgh. We
Pl 26 can gain a good impression of what it looked like from an oil painting (82 in. × 100 in.) which Daguerre made on the spot for this tableau, and which now hangs in the Walker Art Gallery at Liverpool. The gloomy Gothic ruin, with its wall monuments, is lit by brilliant moonlight streaming through the centre window. The whole canvas displays astonishing 'photographic' detail, lighting, and perspective, and this extreme realism is due to Daguerre's use of the camera obscura in sketching. Was it not natural that he, like Fox Talbot some years later, should have wished to find a method by which the fugitive image, which he was so laboriously tracing, could be made to delineate itself? Obsessed by this idea, Daguerre equipped a laboratory at the Diorama near the Place de la République in Paris, and there for several years he carried out mysterious experiments, shutting himself in his workroom for days on end. The famous chemist, J. B. Dumas, relates that Madame Daguerre consulted him one day in 1827 as to whether or not he thought it possible that her husband would be able to fix the images of the camera. 'He is always at the thought; he cannot sleep at night for it. I am afraid he is out of his mind; do you, as a man of science, think it can ever be done, or is he mad?' 'In the present state of knowledge', replied Dumas, 'it cannot be done; but I cannot say it will always remain impossible, nor set the man down as mad who seeks to do it.'[3]

We have already referred to the correspondence between Daguerre and Niépce which began in January 1826 and led to their partnership nearly four years later, and it should be stressed once more that up to that time Daguerre had not succeeded in producing a single picture, not even an unfixed one. Building up upon the materials used by his partner–silvered copper plates, and iodine with which to strengthen the image–Daguerre discovered in 1831 the light-sensitivity of iodide of silver, which he produced by subjecting a silvered copper plate to iodine vapour, as Niépce had done for a different purpose. This silver salt, however, was not sensitive enough to produce an image, and it was not until the spring of 1835 that Daguerre was in a position to ask Isidore Niépce, who according to the contract had succeeded his father, to come to Paris to look at important results.

Daguerre had just discovered the possibility of developing the latent image. How it happened is one of the classic legends of photography. Daguerre put away in his chemical cupboard a plate which had been exposed–apparently as unsuccessfully as usual–intending to repolish and use it again. When, a few days later, he opened the cupboard he found, to his amazement, the under-exposed plate impressed with a distinct picture. He quickly made a number of exposures as before, put the plates in the cupboard one at a time, and by a lengthy process of elimination of the various chemicals it contained he at length established that the vapour from a few drops of spilt mercury from a broken thermometer had worked the miracle. Daguerre himself stated, however, that he had been experimenting with several mercurial compounds, from which 'it was only a short step to the vapours of metallic mercury, and good fortune led me to take it.'[4] This proved the solution to the whole problem, for by this means Daguerre established that a plate need receive only a comparatively short exposure of 20 minutes to half an hour and that the latent image could then be made visible by an after-process.

Though the images were still not permanently fixed, Daguerre felt that his discovery was such an immense improvement upon Niépce's results that the firm should from now on be called Daguerre and Isidore Niépce instead of Niépce-Daguerre. Isidore, in need of money, unwillingly agreed to this, in a signed codicil to the original contract, on 9 May 1835.

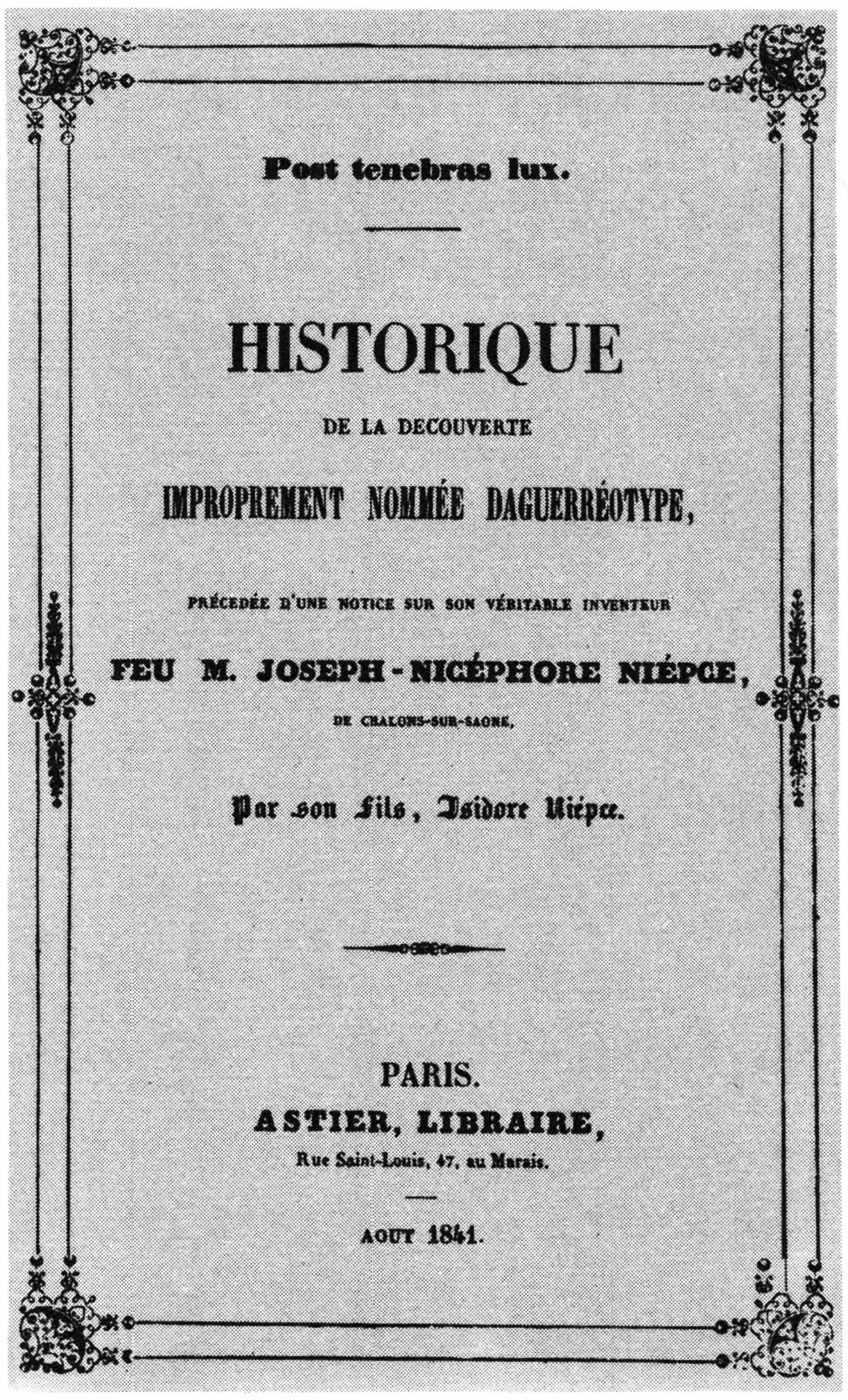
Having been brought an important stage nearer his goal, with his usual self-assurance Daguerre triumphantly but prematurely claimed[5] that he had succeeded in fixing the image of the camera obscura, including portraits. In fact it was not until the first half of 1837 that he was really able to fix his pictures permanently, using a solution of common salt in hot water, whilst the application of the process to portraiture was left to later experimenters.

Daguerre presented the first successful daguerreotype, a still-life in his studio taken in 1837, to M. de Cailleux, Curator of the Louvre, and this is now preserved at the Société Française de Photographie in Paris. Pl 27

Having at last succeeded in fixing the image of the camera obscura by quite different methods from Niépce's, Daguerre felt that his own discoveries had improved the original heliographic process out of all recognition, and in spite of the terms of the original contract, it is perhaps understandable that he should now insist on calling the invention by his name alone–daguerreotype. Isidore Niépce at first indignantly refused to sign the new contract which Daguerre had prepared, but when his partner threatened to publish his process and heliography separately, he gave way (though he protested later), for it was obvious that no one would be interested commercially in the slower process. Fig 2 Moreover, it was clear that Daguerre was concerned only with the honour of being considered the inventor, for he still agreed that the profits from the new process should be divided equally.

Having settled this delicate matter to his satisfaction, Daguerre suggested to Niépce a public subscription to run from 15 March to 15 August 1838, calling for four hundred subscribers at 1,000 francs each, and stipulating that the processes of heliography and daguerreotype should not be made public unless there were at least one hundred subscribers. If sold outright, the price for the inventions should be not less than 200,000 francs (at that time about £8,000).

During the next few months Daguerre attracted all the publicity he could by driving round Paris with the apparatus on a truck, photographing monuments and public buildings; but he failed to find buyers for the shares, or a Maecenas to put down the lump sum required. So, towards the end of 1838, he approached a number



Post tenebras lux.

HISTORIQUE

DE LA DECOUVERTE

IMPROPREMENT NOMMÉE DAGUERRÉOTYPE,

PRÉCÉDÉE D'UNE NOTICE SUR SON VÉRITABLE INVENTEUR

FEU M. JOSEPH-NICÉPHORE NIÉPCE,

DE CHALONS-SUR-SAONE,

Par ſon Fils, Isidore Niépce.

PARIS.
ASTIER, LIBRAIRE,
Rue Saint-Louis, 47, au Marais.

AOUT 1841.

Fig 2 Title-page of Isidore Niépce's brochure, 1841

of leading scientists, including J. B. Dumas, Biot, Humboldt, and Arago, with the purpose of interesting the Government, and he was fortunate in finding in François Dominique Arago an influential ally, for he was a member of the Chamber of Deputies as well as a distinguished physicist and astronomer. Soon afterwards, Arago gave the discovery official status by a brief announcement at the Académie des Sciences, on 7 January 1839. Francis Bauer, remembering the pioneer work of his dead friend, thereupon championed Niépce's cause in a letter to *The Literary Gazette*.[6] Thus Niépce's generosity eleven years earlier enabled Bauer to prove the priority of his old friend, whose name had been omitted from newspaper reports of Arago's preliminary announcement.

After the destruction of the Diorama on 8 March by a fire in which Daguerre lost everything, Arago reiterated that the Government should acquire the invention. In an undated letter written soon after to the Minister of the Interior, Duchatel, Arago asked him to solicit the Chambers for national recompense on behalf of Daguerre.

> Unhappily for the fortune of this talented artist [Arago argued] the method cannot become the object of a patent. As soon as it is known, everyone will be able to apply it; the most clumsy operator will be able to take views as perfect as those of an experienced artist. The author of so fine, so unexpected and so useful a discovery has certainly done honour to his country, and his country alone can recompense him. I know personally that M. Daguerre has refused certain tempting offers made to him in the name of several powerful sovereigns. This circumstance cannot fail to augment the interest which everyone takes in him. . . . I most ardently desire to receive an affirmative answer, in which case I put myself entirely at your disposal, both for the preliminary stipulations and for the discussions that such a proposition might give rise to.

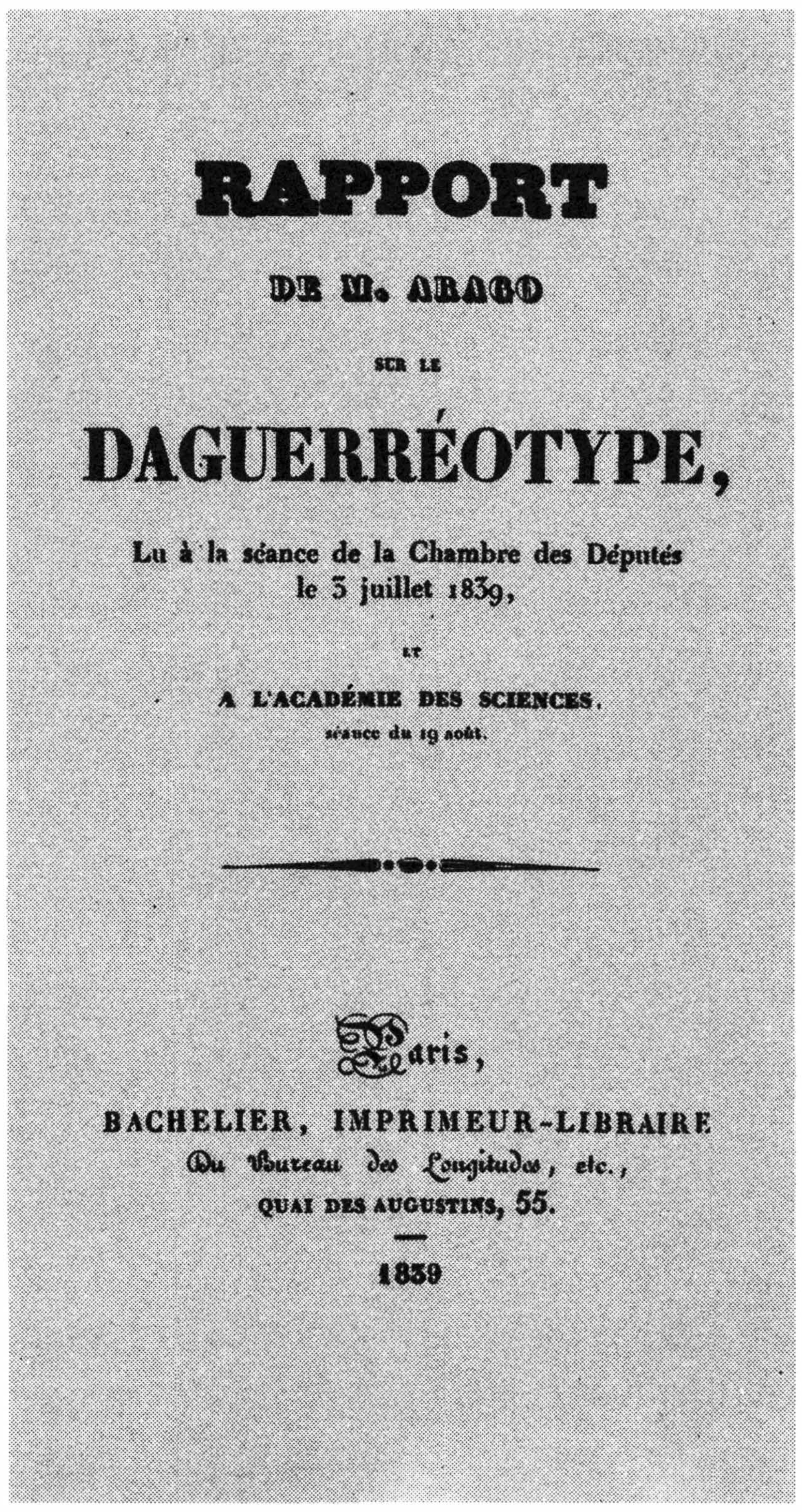
Arago concludes with a sentence which is almost a threat to the Minister:

> In the supposition that, contrary to my expectations and my wishes, you should not think it proper that the Government take the initiative, you will not consider it wrong, I hope, if, acting according to a desire which has arisen from every seat in the Chamber of Deputies, I should endeavour myself, by a formal proposition, to interest that Chamber in the discovery of our ingenious fellow-countryman.[7]

What strength of character Arago reveals in this letter! Daguerre, and through him photography, could not have been entrusted to a better and more energetic sponsor. Impressed by the force of Arago's arguments, the Minister acted promptly. He immediately prepared a Bill proposing that the Government should grant pensions of 6,000 francs for Daguerre (£250 at the time) and 4,000 francs (£166 13*s*. 4*d*.) for Isidore Niépce, the extra amount for Daguerre being in respect of his disclosure of the method of painting the Diorama, and his undertaking to make known any future improvements in his process.

After the Bill had received the King's approval, Duchatel pressed the Chamber of Deputies for their support on 15 June, in phrases borrowed from Arago's letter. The pensions do not seem particularly generous, but were fixed by Daguerre and represent 5 per cent. interest for life on the capital sum of 200,000 francs originally asked for by him and Niépce–a payment justified, Duchatel repeated, by offers they had received from foreign sovereigns. Who were these foreign sovereigns so vaguely referred to by Arago and Duchatel? 'England, Russia, Prussia, and the United States' said Mentienne, an old friend of Daguerre and Mayor of Bry, in 1883.[8] But so far no contemporary documentary evidence has been found to substantiate such claims. The newspaper reporters, having got an exciting story, let imagination loose. The Paris correspondent of the *Morning Post* reported early in March that the Emperor of Russia had offered 500,000 francs (five hundred thousand) for Daguerre's secret, but that he had declined the grand reward. The correspondent added, 'It is not likely that his friend Mr Arago will succeed in obtaining a larger national one from the Chambers.' Daguerre may well have been bragging about such offers, in the hope of influencing the French government, and we would also discount the statement in a biographical article published by the Institut des Archives Historiques:[9] 'England had offered the inventor a sum of 200,000 francs for his discovery, but the artist preferred to give it to his country.' Hardly likely, considering England's indifference to Niépce's and Talbot's inventions. Moreover the statement is contradicted by the facts given on page 132.

At various sessions of the Chamber of Deputies and Chamber of Peers the invention was praised highly by members of the Government, as well as by leading scientists and artists who had been asked to report on it. Duchatel and Arago exalted the merits of Daguerre's invention at the expense of Niépce's pioneer work.[10] The Minister of the Interior stated, for instance, that 'he [Niépce] obtained only a silhouette or black profile of objects, and twelve hours at least were required to produce even the smallest design',[11] while the exposure required by Daguerre's process was said by Arago to be only 'ten or twelve minutes in the dull weather of winter. . . . In summer this time may be reduced one-half.' 'The daguerreotype', continued Arago, 'does not demand a single manipulation which is not perfectly easy to every person. It requires no knowledge of drawing, and does not depend upon any manual dexterity. By observing a few very simple directions, anyone may succeed with the same certainty and perform as well as the author of the invention.' Gay-Lussac reported to the French Upper Chamber that the process 'is the origin of a new art in the midst of an old civilization; an art which will constitute an era, and be preserved as a title of glory. . . . Let it stand forth as a splendid evidence of the protection which



RAPPORT

DE M. ARAGO

SUR LE

DAGUERRÉOTYPE,

Lu à la séance de la Chambre des Députés
le 3 juillet 1839,

ET

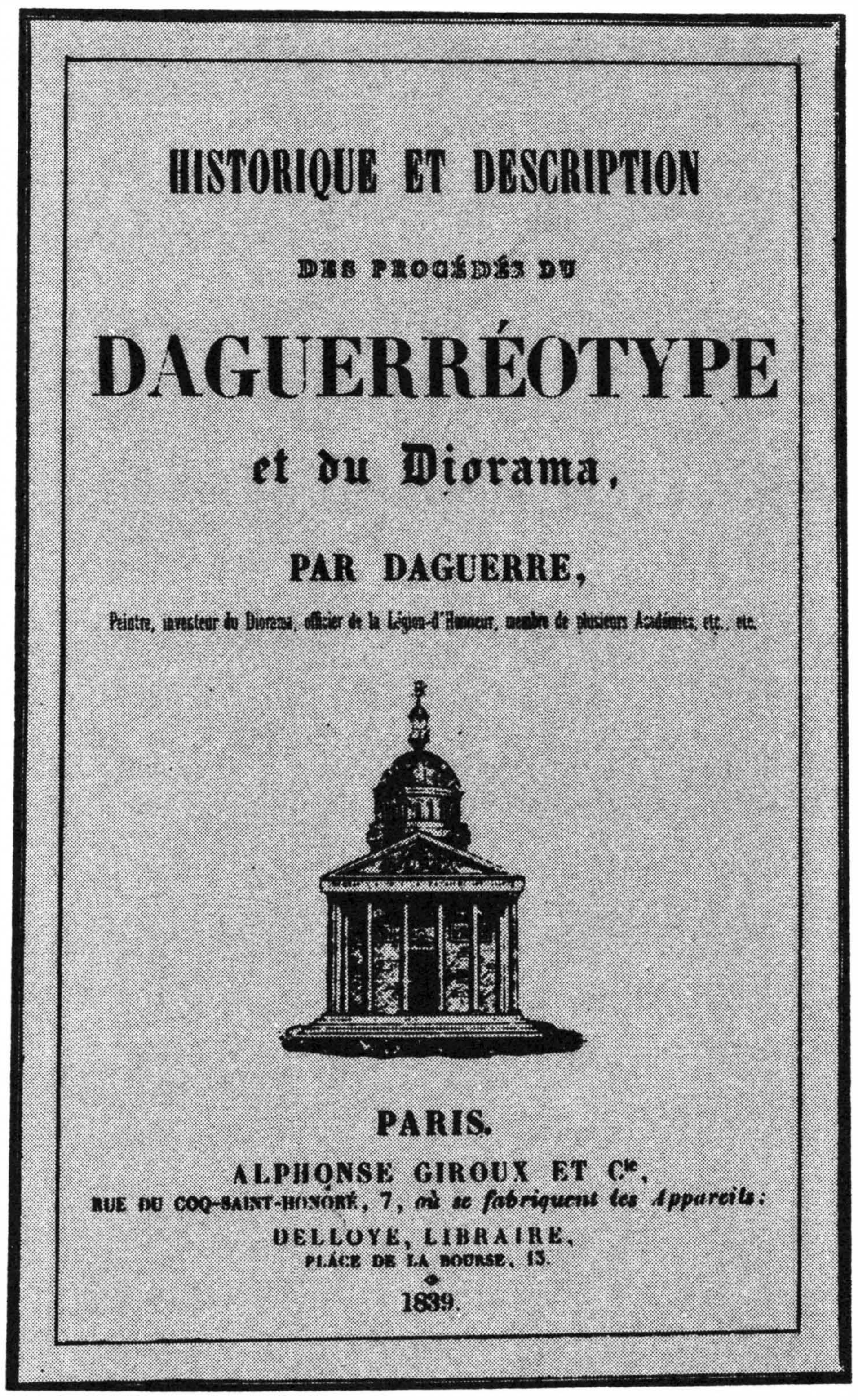
A L'ACADÉMIE DES SCIENCES,
séance du 19 août.

Paris,

BACHELIER, IMPRIMEUR-LIBRAIRE
Du Bureau des Longitudes, etc.,
QUAI DES AUGUSTINS, 55.

1839

Fig 3 Arago's report on the daguerreotype, published 31 Aug. 1839



HISTORIQUE ET DESCRIPTION

DES PROCÉDÉS DU

DAGUERRÉOTYPE

et du Diorama,

PAR DAGUERRE,

Peintre, inventeur du Diorama, officier de la Légion-d'Honneur, membre de plusieurs Académies, etc., etc.

PARIS.

ALPHONSE GIROUX ET Cie,
RUE DU COQ-SAINT-HONORÉ, 7, *où se fabriquent les Appareils:*
DELLOYE, LIBRAIRE,
PLACE DE LA BOURSE, 13.

1839.

Fig 4 Cover of first edition of Daguerre's manual, 1839

the Chambers–the whole country–afford to great inventions.' And he reiterated the perfection of the invention in a statement which could not fail to cause amazement: 'The daguerreotype represents inanimate nature with a degree of perfection unattainable by the ordinary processes of drawing and painting–a perfection equal to that of Nature herself.'

'From today painting is dead!' exclaimed Paul Delaroche in bewilderment on first seeing a daguerreotype. This remark expresses the profound consternation aroused among painters and engravers, who quite understandably feared to lose their means of livelihood, when anyone could now do in a fraction of the time what took an artist all day, or even longer.

The Bill presented by Arago was enthusiastically passed by both Chambers. The invention was by now a matter of national pride, and on 19 August Arago announced details of the manipulation before a crowded joint meeting of the Académies des Sciences and des Beaux-Arts at the Institut de France. 'There was as much excitement as after a victorious battle', we are told by an eye-witness in a lively account of the nervous excitement of the dense crowd that filled the meeting and overflowed into the courtyard and on to the banks of the Seine. Fig 3

> Truly a victory–greater than any bloody one–had been won, a victory of science. The crowd was like an electric battery sending out a stream of sparks. Everyone was happy to see others in a happy mood. In the kingdom of unending progress another frontier had fallen. Often it seems to me as if posterity could never be capable of such enthusiasm.
>
> Gradually I managed to push through the crowd and attached myself to a group near the meeting-place, who seemed to be scientists. Here I felt myself at last closer

> to events, both spiritually and physically. After a long wait, a door opens in the background and the first of the audience to come out rush into the vestibule. 'Silver iodide' cries one. 'Quicksilver!' shouts another, while a third maintains that hyposulphite of soda is the name of the secret substance. Everyone pricks his ears, but nobody understands anything. Dense circles form round single speakers, and the crowd surges forward in order to snatch bits of news here and there. At length our group too manages to catch hold of the coat-tails of one of the lucky audience and make him speak out. Thus the secret gradually unfolds itself, but for a long time still, the excited crowd mills to and fro under the arcades of the Institute, and on the Pont des Arts, before it can make up its mind to return to everyday things.
>
> An hour later, all the opticians' shops were besieged, but could not rake together enough instruments to satisfy the onrushing army of would-be daguerreotypists; a few days later you could see in all the squares of Paris three-legged dark-boxes planted in front of churches and palaces. All the physicists, chemists, and learned men of the capital were polishing silvered plates, and even the better-class grocers found it impossible to deny themselves the pleasure of sacrificing some of their means on the altar of progress, evaporating it in iodine and consuming it in mercury vapour.
>
> Soon there appeared a pamphlet in which Daguerre fully described his process, and as, alas, my money was not sufficient to buy the apparatus, I bought the brochure in order to be able at least to daguerreotype in imagination. I still see it before me, its violet-grey covers decorated with a vignette of the Pantheon with the inscription 'Aux grands hommes la patrie reconnaissante'. The publisher could not help rubbing in the immortality of the inventor in this rather obvious way.[12] Fig 4

One edition after another of Daguerre's manual, prepared by command of the Government, was sold out; twenty-nine editions, in six languages, were published by the end of the year, not counting a number of brochures by other people.[13]

At the Conservatoire des Arts et Métiers the inventor himself gave weekly demonstrations of the process. After the silvered copper plate had been thoroughly cleaned and polished, it was sensitized by vapour of iodine in an iodizing-box, forming a thin layer of silver iodide on its surface. After exposure the latent image was developed by vapour of mercury heated over a spirit-lamp, the mercury attaching itself to those parts of the silver iodide which had been affected by light. The picture was then fixed with hyposulphite of soda (before March 1839 this was done with common salt), washed with distilled water, and gently dried over a flame as any water-drop adhering to the surface would have left a mark. To protect the delicate deposit of mercury from abrasion, the daguerreotype had to be framed behind glass, and the edges carefully sealed to prevent oxidation of the silver.

Perhaps no other invention ever captured the imagination of the public to such a degree and conquered the world with such lightning rapidity as the daguerreotype. All Paris was seized with 'daguerreotypomania', so amusingly derided by Théodore Maurisset in December 1839. Pl 29 The caricature shows a crowd of people pushing into the enterprising establishment of Susse Frères, attracted by an enormous advertisement to buy daguerreotypes for New Year's gifts. Over the entrance large notices proclaim that 'non-inverted pictures can be taken in 13 minutes without sunshine.'[14] While one photographer is just aiming his camera up the skirts of a tightrope dancer on the left, another tries to take the portrait of a child whose mother and nanny do their best to keep his struggles in check. Baron Séguier, inventor of the portable apparatus for travellers (see page 74) passes by, his boxes tucked under his arm. Their contents are displayed in the right foreground, where Dr Donné, who was among the first to attempt portraits, holds a sitter imprisoned in a posing-chair as if he were in the stocks, calmly counting the minutes while his victim endures the torture. Above this pleasant open-air studio, daguerreotypes are etched according to Donné's system (see page 539). A procession of daguerreotype enthusiasts bearing a banner with the inscription 'Down with the aquatint' passes the gallows, where a few engravers deprived of their livelihood have hanged themselves, while other gallows are still to be let. Nearby, a group of revellers dance to music round a mercury-box as if it were the Golden Calf. Train- and ship-loads of cameras are being exported, and the daguerreotypists have good reason for holding a public meeting to worship the invention: has not competition by rival firms (to Giroux's) already reduced the price of apparatus to 300, 250 and even 200 francs? The sun smiles down benignly on his creation. Surveying the things that had come to pass during the last few months, Maurisset adds a touch of prophecy: nineteen years before Nadar (see page 507), he illustrates a photographer recording the scene from a balloon with a basket in the form of a camera.

Pl 30 Everywhere in the city daguerreotypists were to be found eagerly showing one another their first results–usually views of roofs and chimney-pots–the most convenient subject to take from one's bedroom window–and with pride and joy they counted the tiles on the roofs and marvelled at the wonderful detail and fidelity with which the texture of the bricks and mortar was recorded.

Light is that silent artist
Which without the aid of man
Designs on silver bright
Daguerre's immortal plan.[15]

Daguerre was made an Officer of the Legion of Honour, and the Minister of Foreign Affairs proudly sent specimens of the new art to the heads of foreign states. The response was immediate: the Emperor of Austria and the Kings of Prussia and Bavaria, as well as numerous scientific academies, honoured the inventor.

Enthusiasm was general, apart from a few conservative elements–people of Colonel Sibthorp's calibre–who, by nature opposed to everything novel, thundered against the invention on moral and religious grounds. The *Leipziger Stadtanzeiger* wrote:

> The wish to capture evanescent reflexions is not only impossible, as has been shown by thorough German investigation, but the mere desire alone, the will to do so, is blasphemy. God created man in His own image, and no man-made machine may fix the image of God. Is it possible that God should have abandoned His eternal principles, and allowed a Frenchman in Paris to give to the world an invention of the Devil?

In England, however, a strong feeling against Daguerre arose when it became known that he had slyly patented his process in London five days before the French Government generously donated it to the whole world (see chapter 12).

In 1840 Daguerre bought a small estate at Bry-sur-Marne, to which he retired with his wife, *née* Louise Georgina Arrowsmith (or Smith)[16] who was of English parentage. At Bry, Daguerre received important visitors from all over the world, and produced another triumph in artistic deception. He painted in the village church, behind the High Altar, a continuation of the nave in such perfect perspective that the unwary visitor is deceived into thinking the church almost twice its actual length.

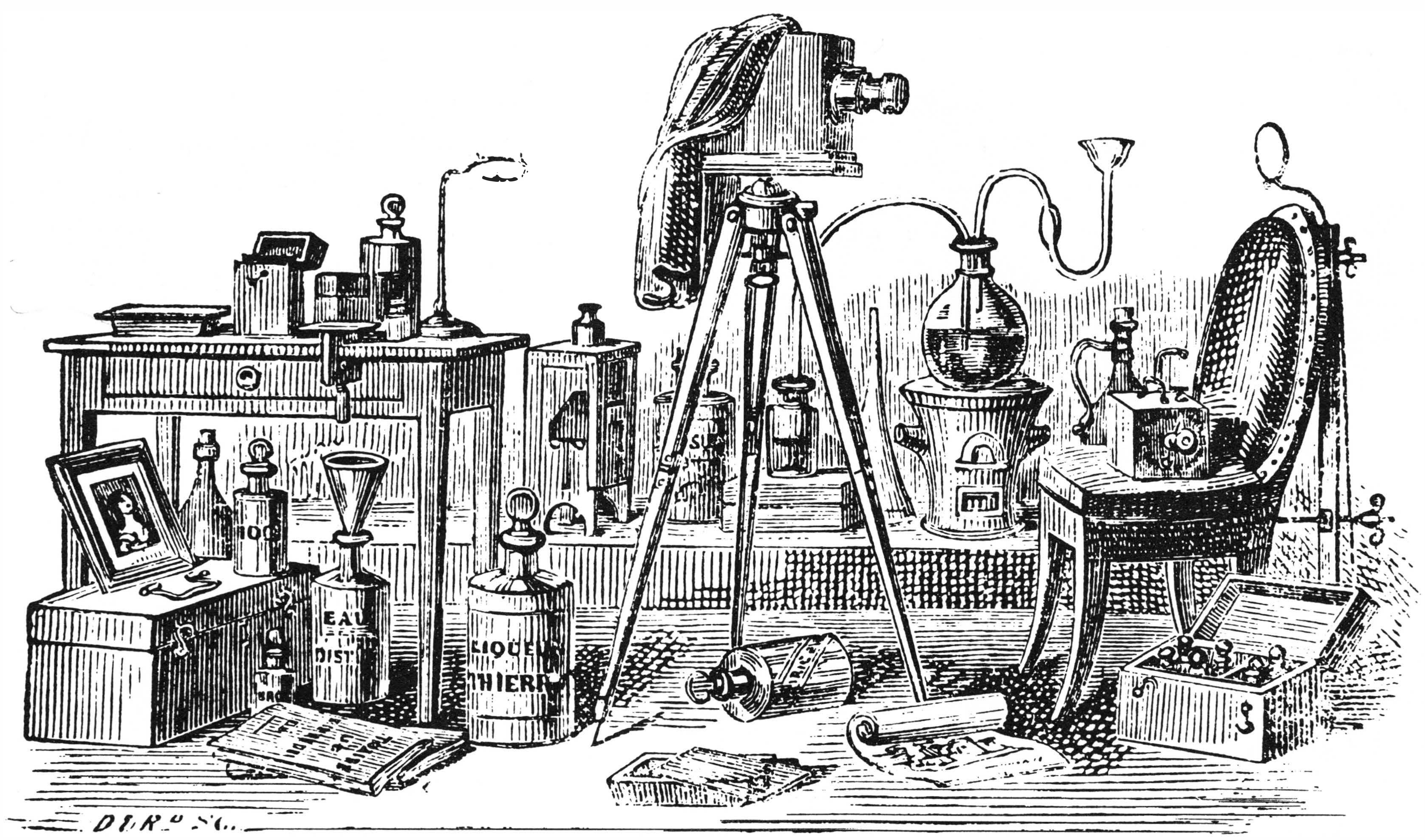


Fig 5 Daguerreotype outfit, vignette from 'Daguerréotypie' by J. Thierry, 1847

Daguerre's epoch-making invention was as yet far from perfect, and it was left to other scientists, American, English, French, and Austrian, to speed up the process and make it applicable to portraiture—the great *desideratum*.

The daguerreotype suffered from inherent disadvantages and for this reason the process must be regarded as a *cul-de-sac*:

(*a*) The mirror-like surface of the silvered copper plate makes the picture difficult to see.
(*b*) The picture, being a direct positive, was laterally reversed.
(*c*) Being on a plate of solid metal, it could not be used as a negative to print copies; each picture was unique. To overcome this, numerous processes were evolved to convert daguerreotypes into printing plates, but the procedures were too complicated for general use. (See chapter 44.)

Daguerreotype cameras. Like Niépce, Daguerre used a camera comprising two boxes, the rear part with the ground-glass sliding within the front part containing the lens. His experimental cameras were obtained from the same Parisian opticians, Charles and Vincent Chevalier. From June 1839 he entrusted Alphonse Giroux, a relative of his wife, with the exclusive manufacture of his cameras, which were expected to be in great demand. Yet in spite of the fact that they were sent all over the world, only a few specimens made by Giroux and bearing his guarantee and seal and Pl 31
Daguerre's signature seem to have survived. They were fairly large ($10\frac{1}{2}$ in. long when closed and 20 in. long when extended, height $12\frac{1}{4}$ in., width $14\frac{1}{2}$ in.), for Daguerre used $6\frac{1}{2}$ in. $\times$ $8\frac{1}{2}$ in. plates. Up to 1841, every camera was fitted with a meniscus or a plano-convex lens, having a focal length of 16 in. and a diameter of about $3\frac{1}{4}$ in. Through a fixed stop of $\frac{15}{16}$ in. diameter, the working aperture of the lens was reduced to F. 17, which made it extremely slow.

This camera remained the standard type for several decades, especially for studio work, until it was finally superseded by the much lighter and more compact bellows camera. As the camera was not patented, the design was copied by practically every

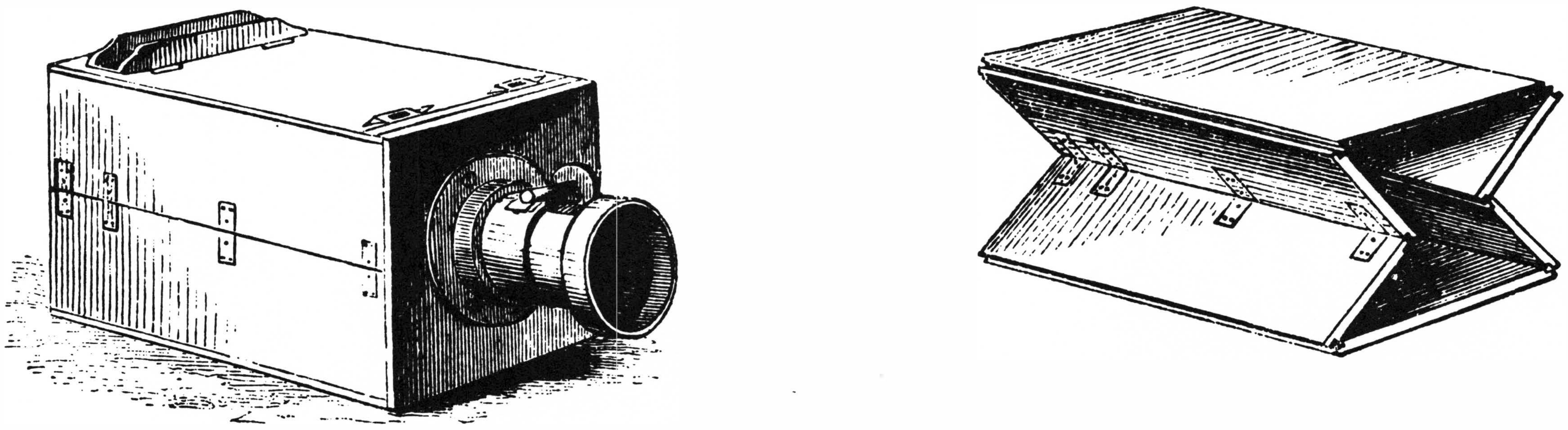


Fig 6 A camera similar to Chevalier's, made by T. & R. Willats, London, 1850

optician. Complete outfits were offered at between 250 francs and 400 francs, the latter being the price charged by Giroux (£16 at the time), which does not seem high compared with the prices of modern precision cameras. Those who wanted a particularly grand outfit could have one for 1,000 francs.

Fig 5 The entire equipment for the daguerreotype process consisted of a box of plates, an iodine box, a mercury box, spirit lamp, a buff for polishing the silvered plates, and of course bottles of various chemicals, and dishes. To reduce bulk and weight for the landscape photographer, Baron Séguier in November 1839 introduced a bellows camera which could be packed with the entire outfit into one wooden box, with a total weight of 35 continental pounds. Chevalier's 'Photographe' which appeared a few months later was a wooden folding camera in which the long sides were made collapsible (after the lens-board and ground-glass had been removed) by being Fig 6 divided horizontally along the middle, and hinged. He also adopted the method of packing the entire equipment into a wooden travelling-box, measuring 19⅜ in. × 11 in. × 8¼ in.

7 *Negative/positive processes on paper*

PHOTOGENIC DRAWING

When Davy published Wedgwood's and his own experiments WILLIAM HENRY FOX TALBOT, F.R.S., was two years old. Unacquainted with their work when beginning his own researches thirty-two years later, Talbot took up the same line of thought and achieved a fair measure of success by the summer of 1835, perfecting his process in the autumn of 1840. Pl 32

Talbot was born on 11 February 1800 at Melbury in Dorsetshire, the home of his maternal grandfather the Earl of Ilchester. His father William Davenport Talbot, an officer of Dragoons, died six months after his son's birth. His mother (*née* Lady Elizabeth Fox Strangways) thereupon let the Talbot family property, Lacock Abbey in Wiltshire. After four years' widowhood she married Captain, later Rear-Admiral, Charles Feilding.

At Harrow and at Trinity College, Cambridge, Fox Talbot's special interests were classics and mathematics, and it was for attainments in the latter field that he was elected a Fellow of the Royal Society in 1831.

Having taken up residence at Lacock Abbey after the tenant's death in 1826, Talbot represented Chippenham as a Liberal in the first Reform Parliament, and took his seat in February 1833; but he soon found that his interests lay less with politics than with science, and the following year abandoned the idea of a political career. In fact, it is doubtful whether Talbot saw much of the House of Commons, for he spent the entire second half of 1833 on the Continent with his wife Constance Mundy, a clergyman's daughter. Talbot was fond of foreign travel, going south whenever opportunity offered. This tour in 1833 had momentous consequences for photography.

In the early days of October Talbot was trying to sketch on the shores of Lake Como, near Bellagio, by means of Wollaston's camera lucida, but, after various fruitless attempts, came to the conclusion that the instrument demanded some knowledge of drawing which he did not possess. While contemplating the matter he remembered the camera obscura which he had used with more success on previous trips abroad, and Pl 37

> this led me to reflect on the inimitable beauty of the pictures of Nature's painting which the glass lens of the camera throws upon the paper in its focus–fairy pictures, creations of a moment, and destined as rapidly to fade away. It was during these thoughts that the idea occurred to me–how charming it would be if it were possible to cause these natural images to imprint themselves durably and remain

> fixed upon the paper! . . . and lest the thought should again escape me between that time and my return to England, I made a careful note of it in writing, and also of such experiments as I thought would be most likely to realise it, if it were possible. And since, according to chemical writers, the nitrate of silver is a substance peculiarly sensitive to the action of light, I resolved to make a trial of it in the first instance.[1]

Soon after returning to Lacock in January 1834 Talbot put his intentions into practice, but, disappointed with the slow action of nitrate of silver, he formed silver chloride on fine quality writing paper by coating it first with a solution of sodium chloride (common salt), and, after drying, with a solution of silver nitrate. This coating darkened no quicker, but Talbot noticed that certain parts, usually at the edges, darkened more rapidly than the rest, and thought this might be due to the fact that they had been less saturated by the sodium chloride solution. Trying out a much weaker solution of this chemical, but still keeping to the same strength of silver nitrate, Talbot was delighted to find his surmise correct: the whole surface of the paper blackened rapidly and uniformly when exposed to sunlight. Indeed, he discovered that too strong a solution of sodium chloride retarded the darkening to such an extent that he subsequently (February 1835)[2] used a strong solution of salt water as a fixing agent, having tried ammonia and potassium iodide with imperfect success.

Having arrived at a means of fixing his pictures, which were so far only contact copies of leaves and lace laid on the sensitized paper and pressed down by a sheet of glass, Talbot next gave all his attention to speeding up the process so as to make camera pictures possible, and eventually succeeded by giving the paper repeated alternate washes of salt and silver, and exposing it in a moist state. Yet when he tried to take a view of Lacock Abbey in a camera obscura which he had made himself out of a large box, he found that the picture was still under-exposed after an hour or two. 'The outline of the roof and the chimneys &c. against the sky was marked enough, but the details of the architecture were feeble and the parts in shadow were left either blank or nearly so.' He thereupon had a number of miniature cameras made by a local carpenter, and these were so tiny (2½ in. square) that his wife called them 'mouse traps'. They were fitted with fixed-focus microscope lenses of short focal length (2 in.), and gave a minute negative 1 in. square. Talbot set up several of these cameras in different positions round Lacock Abbey and after the lapse of half an hour[3] brought them indoors and found in each a miniature image. In this way Talbot took, in the summer of 1835, a number of photographs of his house, which was, however, not 'the first [building] to have drawn its own picture' as he thought, but was preceded by Niépce's house, Gras.

One of these minute negatives is preserved at the Science Museum, London. It is the first paper negative and the second surviving photograph in the world, and Pl 36 represents the window of the library at Lacock Abbey, taken from indoors. For the sake of contrast, Talbot pasted the negative on a black background, for the photograph had apparently already faded during his lifetime. A note which he wrote on it says, 'Latticed window (with the camera obscura) August 1835. When first made, the squares of glass, about 200 in number, could be counted with help of a lens.'

Applying his process to the solar microscope as Davy had done, Talbot obtained photographs of objects magnified seventeen times in linear dimensions. According to his 'Account of the Art of Photogenic Drawing' this was first done in the summer of 1835, yet curiously enough in a letter, dated 10 May 1853,[4] Talbot based his claim for priority in the taking of photomicrographs on the date 'early in 1839'.

It is surprising that Talbot left his photographic experiments at this stage, since he had not really solved the problem he had set himself at Bellagio in 1833–to make the camera supplant the pencil on his travels abroad. So far he had only achieved photographs by a printing-out process which required fairly lengthy exposures, and even then only resulted in negatives too small to be of any practical use. Equally surprising is Talbot's failure to publish an account of his photographic researches even in the imperfect state they had reached. They were obviously subordinate to his multifarious work on other subjects. 'Want of sufficient leisure for experiments was a great obstacle and hindrance', but did not prevent him from publishing papers on other subjects to which he attached more importance.

'However curious the results I had met with', Talbot explained in *The Pencil of Nature,* 'yet I felt convinced that much more important things must remain behind, and that the clue was still wanting to this labyrinth of facts. But as there seemed no immediate prospect of success, I thought of drawing up a short account of what had been done and presenting it to the Royal Society.' Indeed, had it not been for Arago's announcement of Daguerre's discovery on 7 January 1839, it is more than probable that Talbot's photographic process would have remained in the embryonic stage for several more years. When, however, he learned that Daguerre had suceeded in making permanent the images of the camera obscura, Talbot 'was placed in a very unusual dilemma (scarcely to be paralleled in the annals of science), for I was threatened with the loss of all my labour, in case M. Daguerre's process proved to be identical with mine, and in case he published his at Paris before I had time to do so in London.'[5] He therefore immediately sent identical notes to Arago and Biot, claiming priority of invention, and stating that he was preparing an account of his process.

On 25 January there were exhibited in the library of the Royal Institution a number of Photogenic Drawings which Talbot happened to have with him in town, and to which Michael Faraday drew attention after the evening lecture, remarking: 'No human hand has hitherto traced such lines as these drawings display; and what man may hereafter do, now that Dame Nature has become his drawing mistress, it is impossible to predict.' Among the specimens shown were Photogenic Drawings of flowers, leaves, and lace, some prints from *clichés-verre,* a copy of an engraved view of Venice–all obtained by superposition; enlarged images of objects taken with the solar microscope, e.g. shavings of wood showing the pores, and an insect's wing showing the reticulations. Finally, a number of camera photographs of Lacock Abbey taken in the summer of 1835, including the oriel window in Plate 36. Among the engravings were some positive copies, described in a contemporary report as obtained 'by first getting them with the lights and shades reversed, but then copying from the reversed impression'.[6] These are the first positive copies we hear of produced before 1839; an achievement transferred by all other historians to 1841. These pictures were again shown by Talbot at the Royal Society on 31 January when he presented a hastily-prepared paper, 'Some Account of the Art of Photogenic Drawing, or the process by which natural objects may be made to delineate themselves without the aid of the artist's pencil'.[7] Talbot mentioned in it that he only learned of Wedgwood's experiments from a scientific friend *after* having discovered a method of fixing–which would indicate some time after 1834. The scientific friend can only have been Sir David Brewster, who had reviewed Davy's paper in the *Edinburgh Magazine.*[8] Many of the applications of the process described in Talbot's paper were, of course, the same as those of Wedgwood and Davy–copying leaves, paintings-on-glass, microscopic objects, making silhouette portraits, and copying engravings by superposition. These latter Talbot did not oil or wax, as Niépce did, in order not to Pl 34 spoil them, and for the same reason he in this case used the sensitive paper in a dry state, which accounts for the comparatively long exposure of half an hour, i.e. the same as for the tiny pictures taken in the camera obscura.

Referring to the copying of engravings he mentioned:

> If the picture so obtained is first *preserved* [i.e. fixed] so as to bear sunshine, it may be afterwards itself employed as an object to be copied, and by means of this second process the lights and shadows are brought back to their original disposition. In this way we have indeed to contend with the imperfections arising from two processes instead of one, but I believe this will be found merely a difficulty of manipulation. I propose to employ this for the purpose more particularly of multiplying at small expense copies of rare or unique engravings.

In this paragraph Talbot laid the foundation of modern photography: a negative which can be used for the production of an unlimited number of positive copies. However, these early positives cannot have been good, for the editor of *The Mechanics' Magazine* reported of the conversazione at the Royal Institution on 26 April that a Mr C. Golpin 'has succeeded in obviating in some degree the difficulties which have hitherto prevented anything satisfactory being produced.' Even Mr Golpin's one and only positive proof 'presented a hazy appearance and indistinctness'. The difficulty of overcoming some of the technical imperfections–the grain of the paper, for instance–was indeed only a matter of manipulation, depending on perfect fixing (which Talbot's was not) and rendering the negative transparent by waxing it before pulling proofs as Herschel advised Talbot on 12 February (see p. 96).

In his memoir to the Royal Society Talbot mentioned only silhouette portraits, and he explained later that he had laid down as a rule not to include in his statement anything which he had not actually tried: 'Thus, for instance, I have said nothing of perhaps the most important application of which this new art is susceptible, that of taking portraits from life with a camera obscura, because I have not yet accomplished this, although I see no reason to doubt its practicability.'[9]

In his first brief outline of Photogenic Drawing Talbot did not disclose any of the chemicals used. The mode of preparation was only revealed to the Royal Society on 21 February, and exactly a month later his 'Notes respecting a new kind of sensitive paper' were read, Talbot having meanwhile devised another sensitive coating containing bromide of potassium and nitrate of silver, but this silver bromide paper apparently did not come up to expectations for one hears no more of it.

At the British Association meeting at Birmingham in August 1839 Talbot exhibited ninety-five of his Photogenic Drawings. They were classed in four groups: negatives made by the superposition of objects on the sensitive paper, positives from this type of negative, camera pictures both negative and positive, and photomicrographs.

Even before the carefully guarded secret of Daguerre's manipulation was at last revealed on 19 August–six months after the publication of Talbot's process–it was generally known that the two inventors, though pursuing the same idea, had arrived at it independently by quite different methods. For several months previous to this date, Daguerre had shown his results to many leading French and foreign scientists, and he publicly displayed some street views, the interior of his studio, and a group of busts in the Louvre, at the Chamber of Deputies at the beginning of July. Opinion was unanimous that the grainy paper pictures were no match for the brilliant and minutely detailed silvered plates. Sir John Herschel, for example, remarked to Arago in May 1839, 'This is a miracle. Talbot's drawings are childish compared with these.'[10] Talbot was obviously annoyed about this, so Herschel sent him a letter on 24 June, when back in England: 'When I wrote to you from Paris I was just warm from the impression of Daguerre's wonderful pictures. After reflection I feel in no way disposed to abate in my admiration. However, that has not prevented my wishing that the processes which have paper for their field of display should be perfected, as I do not see how else the multiplication of copies can take place. . . .'[11] In 1839 Daguerre's process was doubtless vastly superior to Talbot's not only in rendering detail but also in speed, producing within the same space of time fairly large (8½ in. × 6½ in.) direct positives in the camera, compared with Talbot's 1-in.-square negatives.

Photogenic Drawing completely failed to capture the imagination of the public, for it was, for all practical purposes, confined to copying objects by superposition. Copying leaves or microscopic objects was of interest to comparatively few people, Pl 35 and there were many who voiced their opinion that this kind of picture-making was nothing new–except for the fixing, of course–not realizing that this very exception made a world of difference between Wedgwood's and Davy's experiments, and Talbot's own. Talbot did not sufficiently stress the enormous possibilities which would be opened up once the process was sufficiently improved to allow of taking really successful camera photographs. Last but not least, the circumstance that several people in England and on the Continent claimed to have taken paper photographs already could not fail to detract from the importance of Talbot's discovery. But even allowing for the initial superiority of Daguerre's process and other factors, and for differences inherent in the character of the two nations, the contrast between the enthusiasm with which Daguerre's discovery was hailed in France, and the cool indifference accorded to Talbot's Photogenic Drawing in this country was so marked that we cannot fail to comment upon it; for this caused Talbot much bitterness, and from his bitterness sprang his irritation and constant bickering with photographers. Talbot was not in need of a pension–though far from being a *rich* landowner–but he rightly expected and deserved official recognition and honour. Even the Royal Society, of which he was, after all, a Fellow, relegated his revolutionary communication to their *Proceedings*, in which only abstracts were published, instead of giving it *in extenso* in the *Philosophical Transactions*. Talbot thereupon published 'Some Account of the Art of Photogenic Drawing' privately in a small edition, and this 13-page brochure which appeared in February 1839 constitutes the world's first separate publication on photography. As recognition was not freely forthcoming, Talbot enforced it by patenting his improved process, the calotype, in 1841, and kept a vigilant eye on all trespassers on his rights.

'Photogenic drawing paper by means of which the most delicate and beautiful object, either of Nature or Art, may be accurately copied' was prepared by J. T. Cooper, the resident chemist of the Polytechnic Institution and advertised for sale in *The Athenaeum* as early as 16 March 1839.

> This mode of drawing [continues the advertisement] can be accomplished in a few minutes and is particularly applicable to the copying of prints, drawings, patterns of lace, plants, &c. &c. In packages of 12 8vo sheets with directions for use &c. Price 5s. May be had of the following opticians: Newman, Regent Street; Watkins and Hill, 5 Charing-cross; Cary, 181 Strand; where specimens may be seen. The trade supplied.

Though it is not mentioned, one assumes that the buyer of the paper was able to obtain at the same time the necessary fixing solution. In a subsequent communication to the Society of Arts Cooper explained his mode of preparing the photogenic paper on such a large scale, and also his method of fixing and the test employed 'to ascertain whether a photographic drawing is permanent or not'.

On 6 April Ackermann & Co., the well-known printsellers in the Strand, advertised in the same paper

> Ackermann's Photogenic Drawing Box for copying objects by means of the sun, containing the various requisites and instructions for carrying out this most important and useful discovery: particularly recommended to Botanists, Entomologists, and the scientific; sufficiently clear to enable ladies to practise this pleasing art. Price per box 21s. N.B. The prepared paper may be had separately 2s. per packet.

Ackermann's photogenic drawing box, it should be explained, was not a camera but merely a box containing the necessary chemicals, brushes, etc., for making photogenic drawings by superposition. Fig 7 The accompanying eight-page instruction booklet, of which we have been able to trace one copy in the library of the Royal Photographic Society, is the world's first 'photographic' manual.[12]

The confusion that reigned in the early days concerning the terminology by which Daguerre's and Talbot's inventions were known is revealed by the titles of two manuals, both published in September 1839. J. S. Memes adopted Talbot's nomenclature for his translation of Daguerre's manual, *History and Practice of Photogenic Drawing on the True Principles of the Daguerreotype*, while a description of Talbot's method was published by F. A. W. Netto in Halle under the title *Vollständige Anweisung zur Verfertigung Daguerre'scher Lichtbilder auf Papier*.

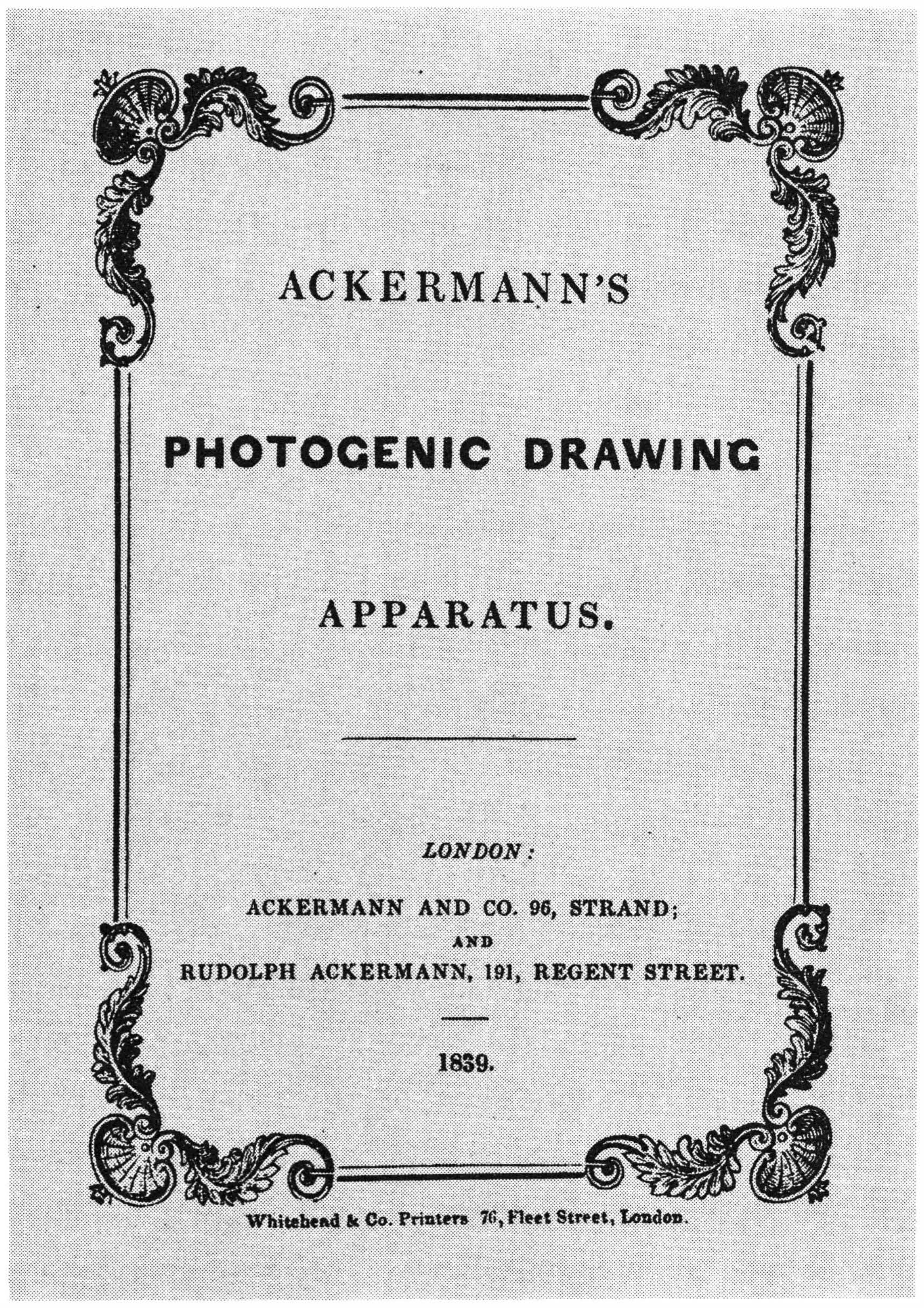
The first general treatise on photography on metal, on paper, and on glass Fig 8 (Herschel's process) was published in May 1841 by Robert Hunt.

The first photographic camera ever made for sale to the public was advertised by Francis West, an optician of 83 Fleet Street, London, in *The Mirror of Literature, Amusement and Instruction*, vol. xxxiii, June 1839.

> Francis West's New Heliographic Camera with Brass Adjustments adapted to Mr Fox Talbot's Photogenic Drawing. Now ready. Price 26s. to 30s. Also Photogenic Drawing Paper, and Fixing Liquid, prepared by an Eminent Chemist: this Paper, it is presumed, will stand unrivalled for delicacy of tint, and sensibility to the solar rays. Paper 4s. per packet. Liquid, 2s. 6d. per bottle.

Spurred on by Daguerre's success, Talbot immediately set to work to speed up his process and to concentrate on camera pictures. A bill from the optician Andrew Ross shows that during 1839 he constructed several cameras for Talbot of larger size than the locally made 'mousetraps', and fitted with achromatic lenses. With these Talbot took during 1839 and 1840 at least twenty-eight photographs of buildings and sculpture,[13] with exposures varying from half to one hour, but on 20–21 September 1840 Talbot made the important discovery of the latent image and the possibility of its development. When a batch of exposed photogenic paper failed to produce a visible image, Talbot thought he would use the sheets again for fresh exposures, and we can imagine his astonishment when on resensitizing them with gallo-nitrate of silver (having been informed of the accelerating properties of gallic acid) the latent image was at once brought out.

> This immediately changed my whole system of work in photography [wrote Talbot].[14] The acceleration obtained was so great, amounting to fully one hundred times, that, whereas it formerly took me an hour to take a pretty large camera view of a building, the same now only took about half a minute, so that instead



ACKERMANN'S

PHOTOGENIC DRAWING

APPARATUS.

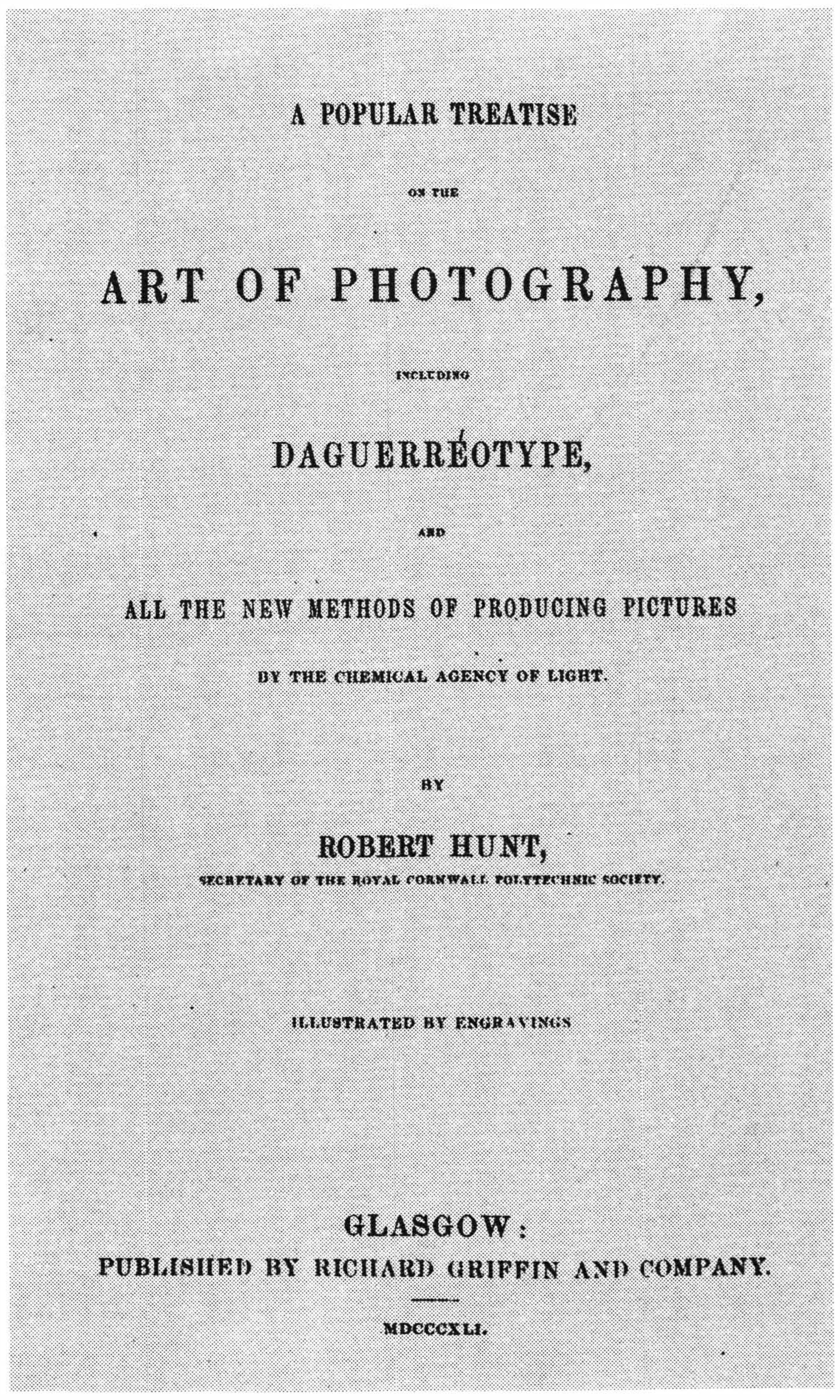
LONDON:

ACKERMANN AND CO. 96, STRAND;
AND
RUDOLPH ACKERMANN, 191, REGENT STREET.

1839.

Whitehead & Co. Printers 76, Fleet Street, London.

Fig. 7 Title-page of manual accompanying Ackerman's Photogenic Drawing Box, April 1839



A POPULAR TREATISE
ON THE
ART OF PHOTOGRAPHY,
INCLUDING
DAGUERRÉOTYPE,
AND
ALL THE NEW METHODS OF PRODUCING PICTURES
BY THE CHEMICAL AGENCY OF LIGHT.

BY
ROBERT HUNT,
SECRETARY OF THE ROYAL CORNWALL POLYTECHNIC SOCIETY.

ILLUSTRATED BY ENGRAVINGS

GLASGOW:
PUBLISHED BY RICHARD GRIFFIN AND COMPANY.
MDCCCXLI.

Fig 8 Title-page of Robert Hunt's first general treatise on photography on metal, paper and glass, May 1841

> of having to watch the camera for a long period, and guard against gusts of wind and other accidents, I had now to watch it for barely a minute or so. Portraits were now easily taken in moderate daylight, a condition essential to success.[15]

Of particular interest are a number of photographs taken by the new process, which Talbot sent immediately to Herschel, and which are now in the Gernsheim Collection. They are mostly whole-plate size, signed and dated by Talbot, a few even bearing a note of the exposure time. They were still fixed by Talbot's much less efficient methods with common salt (when they have a pink and mauve colour) or potassium bromide (giving a pale yellow colour with brown shadows). Especially noteworthy in this series are the carriage of Talbot's mother and stepfather whose name Feilding can be discerned on the coachman's box; a footman is holding the carriage door open. This picture bears in Talbot's handwriting the remark '1840. Done in 3 minutes', and must be one of the earliest photographs–if not the earliest–taken by Talbot of a human being. The comparative shortness of the exposure proves it to be a calotype, and as there are still plenty of leaves on the trees the date cannot be later than the end of September 1840, immediately after his discovery of development. Talbot was obviously not deterred from photographing during the winter, for there is a view of the country covered with snow dated 'Winter of 1840–41', and also a bare tree in the grounds of Lacock Abbey taken in February 1841 and bearing the note 'Done in 1 minute'. A picture of a barn and cart was also taken at Lacock Abbey in 1840, but as it bears no exposure time it is impossible to say whether it is a Photogenic Drawing taken before 21 September, or a calotype taken after that date.

Talbot sent a brief statement about his discovery to J. B. Biot, the French physicist, who read it before the Académie des Sciences on 18 January 1841; two months later he was able to show the Académie a photograph of the cloisters of Lacock Abbey, with the figure of a man, taken in exactly 1 minute. It aroused great interest and was passed from hand to hand, Biot pointing out that the ivy had come out too dark owing to the small chemical effect of green rays.

THE CALOTYPE

Meanwhile three days before patenting his improved process–which he called 'calotype' (Greek, ϰαλός, beautiful)–on 8 February 1841, Talbot sent a letter concerning his discovery to *The Literary Gazette*, but neither in this nor in his fuller letter of 19 February did he disclose the manipulation. Whether in taking this step he was only following the precedent set by Daguerre–as is often apologetically explained by his friends–is more than doubtful, for as early as January 1839 Talbot had been considering patenting Photogenic Drawing and was in correspondence about the ethics of the idea with his friend Sir David Brewster, who advised him on 4 February, 'You ought to keep it perfectly secret until you find you cannot advance further in the matter, and then it would be advisable to secure your right by a patent. I do not see why a gentleman with an independent fortune should scruple to accept benefit that he has derived from his own genius.'[16] Also included in the patent specification was a method of making direct positives on paper in the camera and by superposition, the exposure for the former being 5 to 10 minutes, and for the latter a minute or two. In this method Talbot had, however, been preceded by H. Bayard, Lassaigne, and Vérignon in France, and to some degree by Dr Andrew Fyfe of Edinburgh, and Sir John Herschel. For this reason we refrain from describing the principle here, and it will be discussed in chapter 8. Curiously enough, Talbot made no reference to this part of his patent in his communication to Biot, which was read before the Académie des Sciences on 7 June, nor in his 'Account of some Recent Improvements in Photography' which he read before the Royal Society three days later.[17] Incidentally, it is strange that no objection was raised by the Royal Society to the communication of an invention which had been previously secured by a patent.

In the calotype process good-quality writing paper was coated successively with solutions of nitrate of silver and iodide of potassium, forming silver iodide. The iodized paper was then rendered more sensitive by brushing it over with solutions of gallic acid and nitrate of silver, and exposed in the camera while still slightly moist, or in a dry state. After exposure, the latent image was developed with a further application of gallo-nitrate of silver solution and became visible when the paper was warmed by the fire for 1 or 2 minutes. Finally the picture was fixed with a solution of bromide of potassium, which Talbot later abandoned in favour of hyposulphite of soda, the only fixing substance which actually dissolves away the unchanged silver. The application of gallo-nitrate of silver solution had the same function in the talbotype as the mercury developer in the daguerreotype; Talbot's process had now reached the same speed as Daguerre's had with chemical acceleration. The developing agent, gallic acid, was, however, not a discovery of Talbot's, but due to the Rev. J. B. Reade,[18] and this point led to trouble some years later.

Talbot's Cameras. We have already referred to Talbot's earliest miniature cameras
Pl 33 used for his experimental work in 1834–5. Plate 33 shows three types of camera with which he worked after 1839. The camera on the left still has the cube shape of the 'mouse-traps' but is of slightly larger dimensions, and fitted with an improved achromatic lens supplied by the optician Andrew Ross. In order to see how far the

image had imprinted itself upon the slow Photogenic Drawing Paper, Talbot–like Niépce before him–had spy-holes made in the lens-board of some of his cameras. The spy-hole with the plug inserted can be seen in the top right-hand corner of this camera. The camera in the centre is for taking larger pictures about 4½ in. × 6 in., and is fitted with a hinged base-board and wooden ratchet for tilting it. It has a microscope lens in an adjustable focusing-tube. On the right is the type of camera with which Talbot worked the calotype process. Like the Daguerre camera, it consists of two boxes, the rear part sliding within the front box. Since with this process the exposure was reduced from about an hour to a few minutes, the spy-holes had to be abandoned as the light entering would have spoiled the picture taken with such a relatively short exposure. This camera has an achromatic lens with a focusing-screw.

8 Direct positives on paper

Pl 40 HIPPOLYTE BAYARD was born on 20 January 1801 at Breteuil-sur-Noye, a small town in the Department of Oise, where his father was a Justice of the Peace. At first a clerk in a notary's office, Bayard later moved to Paris where he became a civil servant at the Ministry of Finance.

He had long been interested in the chemical action of light, and had been making photographic experiments since 1837. After Arago's announcement on 7 January 1839 of Daguerre's discovery, Bayard redoubled his efforts and began a new series of experiments.

By 5 February he was able to show some imperfect images on paper to César Despretz, later a member of the Institut de France. These first results were negatives on silver chloride paper like Talbot's, but made before details of Talbot's process were published. Learning that Daguerre's pictures were positives, Bayard set to work to make direct positives, thinking they would be an improvement on negatives. It is a curious fact that in the first years of photography the direct positive process was generally regarded as infinitely preferable to the negative/positive process; hence Talbot's inclusion of a method of making direct positives in his calotype patent of 1841, although he had realized the advantage of having one master negative from which to print at low cost a large number of copies. Everyone else, however, merely thought of the technical disadvantage of a double manipulation to achieve a picture representing the lights and shadows according to nature.

On 20 March 1839 Bayard obtained his first direct positives on paper made in the camera. The exposure is stated to have been about an hour. Less than two months went by, and on 13 May he brought J. B. Biot some specimens which he considered good enough to arouse the interest of that well-known physicist, and a week later showed some still better examples to Arago. Bayard's rapid progress is astonishing considering that he had little time for research, being employed all day, and besides this he could afford only a poor lens.

Bayard now judged his discovery sufficiently advanced to display his results publicly. Consequently he hung a large frame containing thirty photographs of still-lifes, sculpture, and architecture at an exhibition which opened on 24 June at auction rooms at 16 Rue de Jeuneurs, in aid of sufferers from an earthquake in Martinique. Though shown among miscellaneous items, Bayard's photographs attracted attention, and *Le Moniteur* reported on 22 July 1839:

> That nothing curious shall be wanting in this collection, in a large frame are exhibited several examples of photogenic or photographic pictures, which have

> been obtained upon paper by the aid of the camera, and which have been produced by a process other than that of M. Daguerre. These specimens are a good augury; if they do not reproduce the colours of objects, if they leave something to desire in the matter of perspective, they indicate at least that the reflecting operation invented by M. Bayard should be susceptible of rapid improvement, and people are already astonished at the truth of the reduced forms presented, in a subdued light, by the objects transferred to the paper.

These facts prove Bayard's complete independence of Talbot's and Daguerre's methods. Bayard deserves a more prominent position as an independent inventor of photography than is generally accorded to him. One wonders at his reticence in not publishing his method; the reason for this silence apparently lies in Arago's request to refrain from making his invention public, in order not to prejudice the success of Daguerre's. A second similar invention would undoubtedly have dimmed the blaze of glory which Arago was then engaged in directing on to Daguerre. This fact, of which Bayard later bitterly complained,[1] was not made known until after Arago's death.[2] Credence may well be given to this story, in view of the zeal with which Arago pushed his protégé's invention; moreover we cannot acquit him of some double-dealing in hypocritically presenting the daguerreotype 'as a gift to the entire world' when he must have known that Daguerre had patented it in England five days earlier. It was probably through Arago's influence that Duchatel, Minister of the Interior, in June 1839, gave Bayard 600 francs (then worth about £25) for the purpose of buying a better camera and lens[3] and to subsidize further experiments, and this official gesture seems to have persuaded the timid inventor to fall in with Arago's wishes.

After the publication of Daguerre's method on 19 August 1839, however, Bayard persuaded the Académie des Beaux-Arts to take up his cause, and they instructed Raoul Rochette to draw up a report on the process, which was read at their meeting on 2 November.[4] Raoul Rochette stressed the ease of manipulation of Bayard's process and its convenience for travellers, as compared with the daguerreotype. He mentioned that the paper could be kept sensitive in a portfolio for a month, and though the exposure was longer than Daguerre's–lasting nearly half an hour–this was compensated by the other advantages. Under-exposed pictures would be useful for artists as a base to paint on. Compared with the results of Talbot who, he wrongly assumed, had so far only been able to produce facsimiles (*contre-calques*) in which black and white were reversed, Bayard's photographs gave the positive effect (*l'effet positif*) of the subject, and were only laterally reversed. Following this the Académie declared the artistic superiority of paper over metal for photography, and recommended Bayard 'to the interest and generosity of the Government'.

A brief mention was made at the Académie des Sciences on 28 October that a communication had been received from Bayard relative to an arrangement he had invented to facilitate the reproduction of enlarged images of objects in the solar microscope by means of photography, but this was not printed in the *Comptes Rendus* and there is consequently no indication of the procedure Bayard had adopted. Possibly it was the same as that contained in a sealed packet which Bayard deposited with the Académie on 11 November 1839, and which was opened at his request at the session of 8 February 1841. Bayard described therein, and included pictures by, a process he had invented in October 1839. With this he had obtained negatives in 18 minutes, the latent image being made visible by subsequent treatment with mercury vapour.

It was not until 24 February 1840 that Bayard divulged to the Académie des Sciences his direct positive process, which he had meanwhile improved further. Since VÉRIGNON described another method of making direct positives on paper at the very same meeting, it would appear that the timing of Bayard's communication was based on information and not on intuition. Bayard began:

> I have deferred until today the publication of the photographic process of which I am the author, wishing first to render this process as perfect as possible; but as I could not prevent some of the information from leaking out, and someone could thus, profiting more or less from my work, take from me the honour of the discovery, I think I should wait no longer in making known the method with which I have succeeded. . . . Here is a summary of what my method consists of. Ordinary letter paper having been prepared following Mr Talbot's method [i.e. silver chloride paper], and blackened by light, I soak it for some seconds in a solution of potassium iodide, then laying the paper upon a slate, I place it in the camera obscura. When the image is formed, I wash the paper in a solution of hyposulphite of soda[5] and then in pure warm water, and dry it in the dark.[6]

Drying the fixed photograph in the dark is typical of the inventor's timidity and lack of confidence. His reference to preparing paper according to Talbot's method was clumsy and might at first sight mislead; had he not shown photographs as early as 5 February 1839, before details of Talbot's manipulation became known anywhere? Why then did he make it? Presumably because Talbot's method was by now generally known and did not form an essential part of Bayard's process.

The direct positive image resulted from the fact that those parts of the paper which were acted on by light were bleached by the separation of iodine from the potassium iodide and its combination with the blackened silver image.

In the process communicated at the same meeting by Vérignon, different chemicals were employed in preparing the paper, so no charge of plagiarism can be brought against this inventor. His method required an exposure of 12 minutes in the camera, in favourable weather.

At the next meeting of the Académie des Sciences LASSAIGNE claimed priority over both Bayard and Vérignon in the production of direct positive photographs, recalling that he had presented his process to the Académie ten months earlier,[7] and in the ensuing controversy both Biot and Arago took part, the latter claiming[8] that the processes presented by Vérignon and Bayard in no way differed from that of Lassaigne, which DR ANDREW FYFE also independently conceived and communicated to the Society of Arts, Edinburgh, on 17 April 1839. However, Arago was mistaken in referring to all these processes as being the same, for although the broad principles involved were identical–making a direct positive by darkening sensitized paper, and by a subsequent process bleaching it–both Bayard and Vérignon produced pictures in the camera, whilst Lassaigne and Dr Fyfe were only able to copy superimposed objects, no doubt because their prepared paper was not sensitive enough to allow of camera pictures. Lassaigne's required 'some hours' for copying engravings. Dr Andrew Fyfe[9] mentioned no exposure time, and did not once refer to any other experiments than copying superimposed objects. He did, however, in an earlier part of his communication discuss Talbot's method of taking Photogenic Drawings in the camera, and Arago must have confused the two processes.

It was particularly unfair of Arago not to mention during this controversy that Bayard had shown him direct positive photographs as long ago as 20 May 1839. Bayard is one of those unfortunate inventors like Scott Archer, who for some reason failed to establish priority through publication, and were in consequence imposed upon by others.

The Académie des Beaux-Arts, the only body that took a proper interest in Bayard's work, appealed to the Government once more in November 1840, recalling their report of the previous year, but to their renewed demand that Bayard's researches be recompensed, no response was forthcoming. Suffering from a sense of injustice, Bayard as a macabre joke in October 1840 took a photograph of himself posed as a corpse propped up, the upper part naked, the lower part wrapped in a curtain. On the back of the print[10] he wrote:

> The corpse which you see here is that of M. Bayard, inventor of the process that has just been shown to you, or the wonderful results of which you will soon see. As far as I know, this inventive and indefatigable experimenter has been occupied for about three years with the perfection of his discovery.
>
> The Academy, the King, and all those who have seen his pictures admired them as you do at this very moment, although he himself considers them still imperfect. This has brought him much honour but not a single *sou*. The Government, which has supported M. Daguerre more than is necessary, declared itself unable to do anything for M. Bayard, and the unhappy man threw himself into the water in despair. Oh, human ficklesness! For a long time artists, scientists and the press took an interest in him, but now that he has been lying in the Morgue for days, no-one has recognized him or claimed him!
>
> Ladies and gentlemen, let's talk of something else so that your sense of smell is not upset, for as you have probably noticed, the face and hands have already started to decompose.

(Bayard's face and hands were sunburnt and came out very dark in the photograph in contrast to his white body.) Two years later, the Société d'Encouragement pour l'Industrie Nationale bestowed on Bayard a prize of 3,000 francs.

Bayard is one of the best representatives of early French photography, and became a founder member of the Société Française de Photographie, which possesses about six hundred of his photographs. Not all, however, were made by the direct positive process, for Bayard also took daguerreotypes and eventually changed over to the albumen-on-glass and collodion processes. Over a century after Bayard's invention a selection of his photographs was published by Lo Duca[11] but the author in his zeal to do justice to Bayard made more errors than he put right. Pl 41

9 *Other independent inventors*

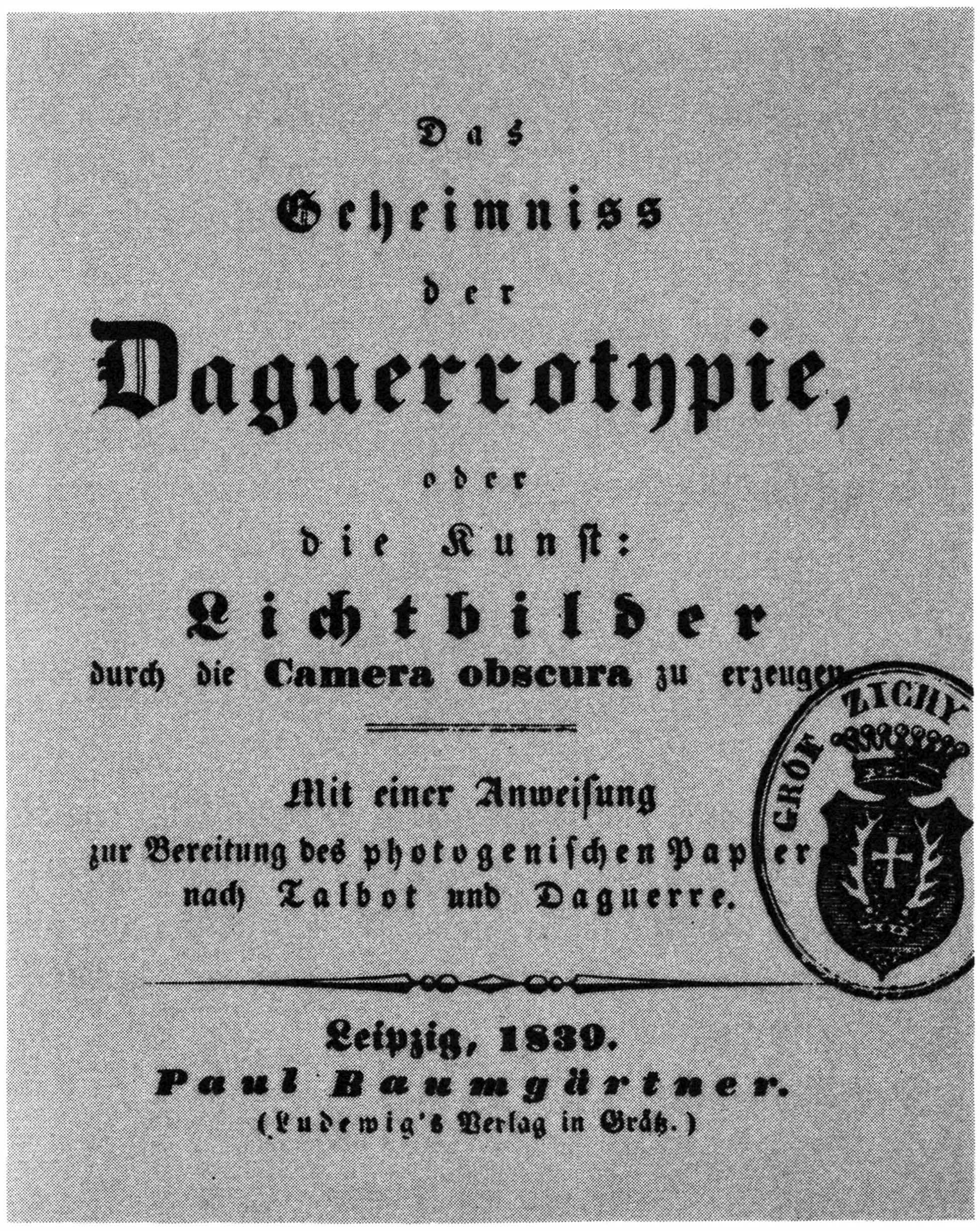
During January 1839 the news of Daguerre's epoch-making discovery spread like wildfire through Europe. The smallest provincial papers copied the news from their larger contemporaries, and curiosity was kept alive by rumours and counter-rumours of the nature of Daguerre's method, which were eagerly spread by Parisian newspaper correspondents, with the assistance of that most excellent publicity manager, Daguerre himself. As usually happens in such cases, a great many people came forward claiming to have made a similar invention already. Though the majority of these claims do not bear investigation,[1] several–apart from those already discussed–are genuine and worthy of being recorded, if for no other reason than as a further indication that the time was ripe for the invention of photography.

FRIEDRICH GERBER, a veterinary surgeon and professor at Berne University, announced on 2 February 1839 in the *Schweizerischer Beobachter*[2] that he had for several years succeeded in fixing the images of the camera obscura. He believed his experiments to have progressed farther than Daguerre's, to judge from the little news which had so far leaked out concerning the latter's invention, and the facts were reprinted Fig 9 in the very first German and Austrian publication on photography *Das Geheimnis der Daguerrotypie* [sic], *oder die Kunst Lichtbilder durch die Camera Obscura zu erzeugen. Mit einer Anweisung zur Bereitung des Photogenischen Papiers nach Talbot und Daguerre*, Leipzig and Graz, (July) 1839. The author, who signs his foreword 'F-n', was probably Karl von Frankenstein, a Graz writer of technical brochures.

Gerber stated that in 1837 he had convinced Professor E. Volmar and other friends of the importance of his invention, which consisted in: (1) fixing the images of illuminated objects in the camera obscura on white paper coated with silver salts; (2) obtaining the images according to nature with regard to light and shade [direct positives]; (3) making any desired number of copies from a specially produced picture by another process on the same principles [negative/positive process].

In conclusion Gerber mentioned that Professor Volmar and he had intended to carry out a series of experiments together, but this had proved impossible so far owing to lack of time, and because his camera obscura had not yet been perfected. He offered, however, to give 'all the necessary information to any art-lover with the necessary time and means, and perhaps also chemical knowledge, who seriously intends to advance this entertaining and useful art by continued experiments'.

From his three-point announcement it is evident that Gerber was perfectly acquainted with all the principles of photography, which he had arrived at independently and in fact made public only one day after Talbot's announcement in London.



Das
Geheimniss
der
Daguerrotypie,
oder
die Kunſt:
Lichtbilder
durch die **Camera obscura** zu erzeugen.

Mit einer Anweiſung
zur Bereitung des photogeniſchen Pap er
nach Talbot und Daguerre.

Leipzig, 1839.
Paul Baumgärtner.
(Ludewig's Verlag in Grätz.)

GRÓF ZICHY

Fig 9 Title-page of the first photographic manual, July 1839, by 'F-N' (probably Karl von Frankenstein, Graz)

Whatever Gerber's practical achievements *in the camera* may have been, they–like Talbot's–had obviously not yet reached a state of perfection, for in a newspaper article on 9 February[3] a hostile critic pointed out that the only pictures *he* had seen were 'excellent copies of small birds' feathers which no artist could have painted better, and which were produced by laying the feathers on the prepared paper'. The anonymous opponent also claimed that neither Gerber nor Daguerre was the inventor of making pictures by light, which had already been done by Dr Young in England and by 'Nips' (Niépce) in France.[4] Thereupon the modest Gerber, not sure of the facts concerning Young and Niépce and hating a public quarrel, declared in the same paper on 23 February, that he unconditionally withdrew any claims of priority of the *idea* of photography, but stressed once more that he had devised his *method* without the slightest hint from anyone, and that, in the absence of contrary evidence from Paris, he still believed himself to be the only person to have obtained enlarged photographic images of microscopic objects.

Five years before Talbot's *The Pencil of Nature* appeared, the idea had occurred to Gerber to illustrate his *Handbook of General Anatomy* with photographs. In the foreword to his book, dated January 1839, Gerber apologizes for the insufficient skill of his drawings (which were reproduced by lithography) explaining that they do not approach the fine detail of the natural objects; these, he continued, could not be copied by the human hand, but only by the art invented by him in 1836, 'by means of which images of microscopic objects were drawn by the delicate hand of Nature herself in the solar microscope. However, this art is not yet suitable for a popular work.'[5]

One of the people acting upon Professor Gerber's suggestion was CAPTAIN BOSCAWEN IBBETSON, an Englishman living in Switzerland. Having seen a daguerreotype, Ibbetson was immediately struck by the idea that it would be preferable to make photographs on paper. On receiving the necessary information from Gerber, he succeeded in producing copies of ferns, grasses, and flowers, which he pasted in an album, entitling it 'Le premier livre imprimé par le soleil'. This was in 1839. When passing through Paris at the beginning of 1840, he showed this album to Arago, who informed him that Talbot had made known such a process some time ago, and this stopped Ibbetson from pursuing the matter farther. He exhibited his album at the Society of Arts photographic exhibition in 1852, and whether or not he had intended to forestall his former teacher by calling his album 'The first book printed by the sun', it is only an album, not a published book illustrated with photographs such as Gerber had in mind, and Talbot produced for the first time in 1844. However, the importance of Ibbetson's account[6] lies in the fact that it testifies to the practical nature of Gerber's process.

An American claim to the production of photographs on paper in 1828 was put forward by Henry H. Snelling in 1851[7] on behalf of James M. Wattles. A young art student at the time, Wattles frequently made landscape sketches with the camera obscura, and like Talbot, Daguerre, and many others, wished that he could fix the images. Though only sixteen, and lacking any knowledge of chemistry, he was of so persevering a nature that after many failures he eventually obtained photographic landscapes by soaking paper in what he called 'a weak solution of caustic' (silver nitrate), then in a solution of potassium, followed by a further dipping in a stronger solution of the first. Wattles obtained pictures in about 45 minutes, and fixed them with a strong solution of common salt. No proof of this claim was produced, but Snelling expressed confidence in Wattles's integrity, and the story is quite probable.

Pl 38 The REV. JOSEPH BANCROFT READE, F.R.S., was a distinguished amateur scientist in the best British tradition: a founder-member and later President of the Microscopical Society, a Fellow of the Royal Society and the Royal Astronomical Society. Successive incumbencies did not preclude his devoting much time to scientific pursuits.

The published statements of Reade concerning his pioneer work in photography made fifteen to twenty years after the event conflict with the facts given to his brother in a recently discovered letter of 1 April 1839, which renders necessary a re-assessment of his claims. The letter was published in full by Arthur T. Gill[8] and we reprint only the relevant passages:

> . . . . . You will perhaps be surprised to hear that the exquisite images of microscopic objects which I produce by means of my solar microscope can now be fixed permanently on the paper which receives them by a certain chemical process. I discovered it on Tuesday last [26 March] at twelve o'clock, and I had one hour of sunshine to put my process to the test. . . . .
>
> It is probable that you already know that this art of Photogenic Drawing has made some stir in London, and all that I lay claim to is the discovery of a prepared paper sufficiently sensitive to be readily acted upon by solar light after it has been greatly attenuated by passing through a double French combination Achromat. . . . I put the same paper into my camera and in the course of an hour I present you with a facsimile of the country.

In the light of this new information all later claims made by Reade have to be post-dated two years. His discovery of a very sensitive paper through the use of gallic acid in conjunction with silver nitrate–which was to form an essential element in Talbot's calotype process–was not made in 1837 as hitherto believed, but evidently on 26 March 1839. Reade's contention to have been the first to employ sodium hyposulphite as a fixing agent has also to be transferred to that date, and so some two months after Herschel's use of it, and twelve days after Herschel's communication to the Royal Society of 14 March, which Reade can hardly have failed to be aware of. It seems, therefore, extremely improbable that he needed to consult William Thomas Brande's *Manual of Chemistry* for this information, as he stated in 1859.[9]

Though Reade's earliest photographic experiments with the microscope may well antedate Talbot's publication of Photogenic Drawing, the date was far more likely 1838 than 1836 as he wrote to Robert Hunt on 13 February 1854.[10]

Reade's only claim to priority over Talbot was his discovery of the accelerating effect of gallic acid, and in his letter of 24 June 1854 he referred Talbot to Willats's manual, the earliest printed source concerning his experiments in this respect.[11]

> So early as April 1839 the Rev. J. B. Reade made a sensitive paper by using infusion of galls after nitrate of silver; by this process Mr Reade obtained several drawings of microscopic objects by means of the solar microscope; the drawings were taken *before the paper was dry*. In a communication to Mr Brayley, Mr Reade proposed the use of gallate or tannate of silver: and Mr Brayley in his public lectures in April and May explained the process.

E. W. Brayley, who was Librarian of the London Institution, on 10 April and again in May exhibited and explained there some of Reade's photomicrographs and copies of botanical specimens obtained by superposition. Reade's letter to Brayley was first published by Robert Hunt fifteen years later.[12] The date given, 9 March 1839, must be a misprint for 9 April, for as we have seen, Reade discovered the process on 26 March.

Reade's dating of his experiments with gallic acid to 1837 instead of 1839, fifteen years after the event, was probably based on the following calculation: he knew that he had been using this accelerator (or rather, developer) two years before Talbot included this vital information in his patent. Yet, since Talbot's announcement of Photogenic Drawing in 1839 made more impact than his improved calotype process patented in 1841 (and many writers even today confuse the calotype process with that of 1839), Reade mistakenly reckoned his two years' priority back from 1839 instead of 1841.

Reade approached photography through his microscopical work. Unable to draw skilfully enough to represent the objects he studied in the microscope, and finding the continued expense of employing an artist too heavy, Reade followed up the photographic experiments of Wedgwood and Davy, and like them, found the pictures more successful on leather than on paper.

> Mrs Reade was so good as to give me a pair of light-coloured leather gloves, that I might repeat Wedgwood's experiment, and her little objection to let me have a second pair led me to say, 'Then I will tan paper.' Accordingly I used an infusion of galls [i.e. gallic acid in its natural form] in the first instance in the early part of the year 1837, when I was engaged in taking photographs of microscopic objects.[13]

Reade's inductive reasoning led him to apply this substance, with which leather is impregnated during the operation of tanning: it was a decided step in advance of earlier experiments with photography on paper. Indeed, the paper became so sensitive that the first attempted photograph turned black all over in a matter of seconds, and the gallic acid solution had to be greatly diluted.

Reade's method consisted in projecting the image from the solar microscope on paper sensitized with solutions of common salt and nitrate of silver, producing silver chloride. (Later on, he found iodide of silver more effective.) This sensitized paper was washed over with gallic acid immediately before and during the exposure, when a sufficiently dense negative was obtained in 2 or 3 minutes. Reade did *not* realize that the gallic acid[14] was developing a latent image–he thought it was merely acting as an accelerator, though he did observe that the image continued to darken under its influence when he stopped out the light from the lens of the microscope.

> I did, however, perceive this phenomenon [development of the latent image] on one occasion, after I had been suddenly called away, when taking an impression of the *Trientalis Europaea*–and surprised enough I was, and stood in astonishment to look at it. . . . I did not realise the *master fact* that the latent image which had been developed was the basis of photographic manipulation. The merit of this discovery is Talbot's, and his only, and I honour him greatly for his skill and earlier discernment. . . . Had my experiments not been so much confined to solar microscope enlargements, but of the more usual kind, like Mr Talbot's, there can be little doubt that the development of the latent image, which in one recorded instance I witnessed, would have been a feather in my cap. But I can admire it just as much in Mr Talbot's cap.[15]

Reade called these photographs of microscopic objects, which were enlarged 50 to 150 times in diameter, 'Solar mezzotints'. One of these was an enlargement of a flea. In addition, he made contact copies of botanical specimens and lace by superposition, and took photographs in the camera obscura. Among the latter were representations of a bust of Pitt, hyacinths in bloom, and a view of his greenhouse with the gardener leaning against it–the first photograph of a person–all taken in the spring of 1839.

Reade also made silhouettes as large as life of himself and his friends, by attaching sensitive paper to a board in a darkened room and posing the sitter in front of it. The shutters were then raised so as to allow the sunshine to darken the paper, which took a few seconds, leaving a white outline of the sitter's features. Though Reade also made some positive copies from his paper negatives, his main interest lay in copying microscopic objects, for which negatives gave finer detail than positive prints.

Reade exhibited a number of his photographs at the Royal Society on 23 April 1839, and at a soirée given by its President, the Marquis of Northampton, four days later. On the latter occasion Talbot also displayed some of his pictures, and Reade took the opportunity to inform him that he had been using an infusion of galls for accelerating and hyposulphite of soda for fixing his photographs. Some years later, when the two scientists met again at the British Association meeting held at Oxford in 1847, Reade brought the matter up once more, and Sir David Brewster, in an historical review of photography[16] wrote, referring to Brayley's lectures, 'The first public use of the infusion of nut-galls, which, as we shall see, is an essential element in Mr Talbot's patented process, appears to be due to Mr Reade, and his process of fixing his pictures by hyposulphite of soda, which has since been universally used as the best . . . must be regarded as an invaluable addition to the photographic art.'

Nevertheless, Talbot included this important accelerator and developer in his calotype patent. Reade would probably never have pressed his claims had he not been roused to indignation by Talbot's behaviour in applying for injunctions against several professional photographers who had availed themselves of the new patent-free collodion process invented by Scott Archer, claiming that this was only a slight variation of his own process, the calotype (or talbotype, as it was then called). It was only then that Reade felt he had to act, not for his own sake but in order to assist others in a just cause, and a tone of measured rebuke, even sarcasm, pervades the letter he sent Talbot on 24 June 1854.

> I may state that I have often been asked to oppose your patent, but I had no wish to meddle with law, or to interfere with the high reputation which your discovery of a process, named after yourself, secured to you, by which 'paper could be made so sensitive that it was darkened in five or six seconds when held close to a wax candle, and gave impressions of leaves by the light of the moon'. This, however, was both subsequent to my own use of gallate of silver, of which you appear never to have heard, and also essentially dependent upon it. In fact, by my process, which, as I stated in my letter to Mr Brayley, was the result of numberless experiments, the important problem was solved, inasmuch as good pictures could be rapidly taken and permanently fixed. . . . Had Mr Brayley's lectures been printed, you would probably have become acquainted with my processes as well as with those of other photographers, which were explained and illustrated by him. At all events, I have never ceased most emphatically to make the claims which in your affidavit you deny me, and therefore, for the sake of furnishing a correct history of the progress of the art, I must be allowed to print this letter, as the only means left to me of meeting the case.[17]

At the celebrated trial *Talbot* v. *Laroche* (see chapter 16) a few months later, Reade appeared as principal witness for the defence. In cross-examination Talbot stated that he did not remember meeting Reade–though he did not, of course, have the least doubt of it–and he admitted, in an almost breathless court, that the optician Andrew Ross (who was acquainted with both Reade and Talbot) had told him in 1840 (the year prior to the calotype patent) that Reade recommended infusion of galls for taking photographs rapidly. (Instructed by Ross, Talbot did what Reade had done, and he succeeded. Moreover by a lucky chance Talbot realized what Reade had failed to see (see page 92).) The jury found that, because Reade had not properly published his discovery, Talbot was 'the first and true inventor within the meaning of the patent laws'–that is, the first to *publish*–but the unavoidable impression remained that Talbot was not justified in patenting discoveries which others had made but not protected by patents.

THE FIRST PHOTOGRAPHS TAKEN IN GERMANY

In Munich two scientists of international repute, FRANZ VON KOBELL, professor of mineralogy, and CARL AUGUST VON STEINHEIL, professor of mathematics, both at Munich University, succeeded in March or April 1839 in fixing the images of the camera obscura on paper coated with chloride of silver. The direct cause of their experiments in photography on paper was a letter from Talbot to the Bavarian Royal Academy of Sciences in which he included his paper 'Some account of the art of Photogenic Drawing' as printed in *The Athenaeum* of 9 February. At a meeting of the Academy exactly a month later Steinheil offered to make a report on the subject, which was read on 13 April when Steinheil and Kobell submitted the results of their own joint experiments.[18] Two important facts emerge. They do not refer to any photographic experiments tried by either of them in 1837–or indeed before March 1839–as was erroneously claimed for them by Dr Rudolf Loher and Professor Erich Stenger:[19] on the contrary, a note in Kobell's handwriting preserved at the

Deutsches Museum, Munich, and first published by the authors in 1959[20] states: 'Photogr. Versuche von mir mit Steinheil, 1839'. Their process, though very similar to Talbot's, was apparently worked out independently, although Talbot's second communication to the Royal Society of 21 February giving his methods must have been available in Munich by March.

Steinheil was responsible for the construction of the camera, whilst Kobell attended to the chemical side. English drawing paper was sensitized several times with silver chloride solution, and on it engravings could be copied in the sun by superposition in about five minutes. As regards camera pictures they found–like Talbot–that the paper was more sensitive when moist, and in order to keep it flat in the camera it was placed between two sheets of mica. We do not learn the exposure time beyond Kobell's general statement, 'If these [the pictures] are not to be too small, they need an exposure of several hours, according to the intensity of the sunlight.' Judging from this the three $2\frac{3}{8}$ in.-square pictures submitted as specimens cannot have been taken in less than half an hour or even an hour. In fact they were exposed until a visible negative image appeared, which means that the process was similar to Talbot's, Gerber's, Reade's, and Bayard's first process. Fixing was done with either caustic ammonia, in which case the colour produced was 'a beautiful warm dark brown', or preferably potassium hyposulphite which imparted a deep violet or even greyish-black tone.

The negatives were apparently too opaque to print from, for Kobell mentions that in order to get the light and shade in the right place they had to be re-photographed. He considered, however, the second pictures (i.e. positives) less good, lacking in contrast, and the four photographs still preserved at the Deutsches Museum in Munich are negatives.

The cylindrical camera designed by Steinheil for the experiments foreshadowed in form Voigtländer's and Thomas Davidson's metal cameras constructed for the daguerreotype process, though it was made of cardboard. The tube was 3 in. in diameter and 5 in. long, and provided with diaphragms. The lens was achromatic, but to judge from the three views–all of buildings in Munich–submitted as specimens with their report to the Academy, Steinheil's lens was surprisingly poor, for the sharpness falls off rapidly from the centre. Nevertheless he remarks, 'The precision far surpasses even the most accomplished [artist's] brush, and is limited only by the structure of the paper when seen through a magnifying glass.'

Steinheil observed that not all subjects are equally suitable for photography. 'Trees, lawns, and anything else green have too weak an effect in proportion to the other colours to give clear pictures; on the other hand, all well-illuminated buildings, groups of rocks, etc., give an excellent image, very true to life, so that they can serve the artist as studies.'

On 28 July Kobell at the Queen's command demonstrated photography at the royal summer palace of Nymphenburg, and it was presumably on that occasion that he took the $1\frac{3}{4}$-in. view of one wing of the palace. About a fortnight later Kobell and Steinheil exhibited two small 'light drawings' of the Glypthothek amongst paintings at the Munich Art Society. The *Vossische Zeitung*, Berlin, reviewing the exhibition on 19 August, remarked: 'They have the appearance of Chinese ink drawings, and are interesting for their novelty and the faithfulness of their representation. These drawings are still rather imperfect, however, and do not yet satisfy their makers, who lavished considerable trouble on them, whereas the incomparable method of Daguerre is admirable in its perfection and is bound to triumph in its practical application over all its competitors.'[21]

HERSCHEL'S CONTRIBUTION TO EARLY PHOTOGRAPHY

It is not surprising that the announcement of the discovery of photography should have caused numerous scientists all over the world immediately to investigate the subject and develop the chemical principles involved. Foremost amongst them was SIR JOHN FREDERICK WILLIAM HERSCHEL, F.R.S., son of Sir William Herschel. Pl 42

As a scientist Sir John Herschel was naturally more interested in the theory of photography than in its practice. Photography is indebted to him for a wealth of ideas, but those who developed them often neglected to acknowledge their originator. Like Reade, Herschel was of a retiring disposition and never pushed forward his claims; indeed, we marvel at the restraint with which he bore the incorrect behaviour of Talbot who, thwarted in his desire for public acclaim, hastened to the Patent Office with more than one idea which Herschel had freely published.

Herschel's photographic researches are concentrated within the first few years after the discovery of photography, and the genius and energy which he displayed were overwhelming. For him, it would have been an easy matter to invent a photographic process earlier had he felt, like Niépce, any urge to do so, or had he believed that it would facilitate his work, as Daguerre and Talbot and Reade did. As far back as 1819 Herschel discovered the property of the hyposulphites as solvents for silver salts,[22] whereas ignorance of this fact had proved the stumbling-block to other investigators in photography for a long time. Herschel's scientific knowledge was indeed so great that on merely receiving a note, on 22 January 1839, from Captain (later Admiral) Beaufort telling him the bare fact of Daguerre's discovery, 'a variety of processes at once presented themselves', and only a week later Herschel succeeded in producing his first photograph.

On 29 January he wrote in his notebook: 'Daguerre's process: attempt to imitate.' Requisites – 1st very susceptible paper; 2nd very perfect camera; 3rd means of arresting further action. Tried hyposulphite of soda to arrest the action of light . . . succeeds perfectly.' The following day Herschel noted: 'Formed image of telescope with the aplanatic lens . . . and placed in focus paper with carbonate of silver. An image was formed in white on sepia-coloured ground . . . which bore washing with hyposulphite of soda and was then no longer alterable by light. Thus Daguerre's problem is so far solved. . . .'[23] So, within one week, Herschel had achieved independently what had taken others years to accomplish. Of course, he did not then know that he had produced a picture by a different method from Daguerre's and Talbot's. On 1 February the latter visited Herschel who showed him a picture of the telescope, 'freshly made'. From a letter Herschel wrote to Talbot eleven days later several facts emerge concerning their meeting which are historically interesting besides underlining certain characteristic traits of Talbot's. Herschel informed Talbot of *his* method of making photographs, without being reciprocated. Talbot disapproved of Herschel's method of fixing with hyposulphite. Talbot was afraid that Herschel might claim priority for copying engravings, which Herschel had devised independently. Herschel suggested that by combining their efforts they might devise a process better than either could alone, but Talbot did not want a collaborator. Herschel most probably gave Talbot the idea of making transparent the engravings to be copied, thus shortening the exposure and obtaining clearer pictures. A postscript (not quoted) and his diary entry for 13 February date Herschel's first experiments with ferrocyanate of potassium. He noted its blue colour, and this probably gave him the idea of the blueprint (cyanotype) process which he communicated to the Royal Society in June 1842.

12 Feb. 1839

> I shall mention no further the process of washing out with hyposulphite if you disapprove of it, and shall wait with patience for the revelation of your mode of fixing, which must be a very chemical *bijou*. I read in *The Athenaeum* of Saturday your mention of copying engravings, but of course I have no idea of claiming a priority in that or any other application, though I had no knowledge of that or any part of the contents of your paper till that *Athenaeum* arrived, beyond what you had shewed me here.
>
> However, to do it *beautifully* is an art to be learned, and many and curious minutiae will have to be discovered and reduced to practice before either of us can arrive at that perfection which I am confident the thing is capable of. And it is very probable that in studying those processes each may hit on something useful on different lines, and on comparing notes a process may arise better than either would have devised separately.
>
> I find, for instance, that by well varnishing the backs of the engravings with mastic varnish the process is greatly shortened, and that in very gloomy days it is practical to get good results. . . .[24]
>
> (The letter continues with some surmises about Daguerre's process.)

Only a few weeks after Talbot's announcement, on 14 March 1839 Herschel read a paper to the Royal Society 'On the Art of Photography; or the application of the chemical rays of light to the purpose of pictorial representation',[25] in which he drew attention to the superior qualities of hyposulphite of soda[26] to common salt and other substances used for fixing photographs. Daguerre immediately adopted it, as did Reade and Bayard, but Talbot for a long time obstinately persisted in his own inadequate fixing methods with common salt or potassium bromide–and then finally went a step farther and incorporated hypo in his patent of 1843. Herschel's communication was accompanied by twenty-three photographs on paper, some negatives and others positives, but only one had been taken in the camera; the rest were copies of engravings or drawings.

The word 'photograph', long believed to have been published for the first time by Herschel in this paper, was in 1932 found by Professor Stenger to have been used a fortnight earlier by the German astronomer JOHANN HEINRICH VON MÄDLER in an article in the *Vossische Zeitung* on 25 February 1839. According to Harold White, SIR CHARLES WHEATSTONE used the term 'photography' in a letter to Talbot dated 2 February. The verb 'to photograph' and the adjective 'photographic' were entered by Herschel in his notebook of chemical experiments several times early in February. In a letter to Talbot on 28 February, he put forward the suggestion that the word 'photographic' should be substituted for Talbot's 'photogenic', on the ground that the latter term did not lend itself to any inflexions.

The choice of the verb 'to photograph' must have been fairly obvious to scientists (Greek, φῶς, φωτός, light; γράφειν, to write). The first part was in use at least since the seventeenth century in the combination 'Photognomia' (knowledge of light), while the term 'graph' had been used in numerous compound words for hundreds of years. There were some people, however, who held that the noun should be 'photogram' not 'photograph', and following the introduction of the word 'telegram', which caused a lively controversy in *The Times,* an attempt was made to substitute 'photogram' for 'photograph'. The editor of *The Photographic Journal* wrote in April 1858 that he wished the new word every success 'which its undoubted correctness deserves', but he feared it was too late to make the change. From that time on the word 'photogram' was frequently adopted by writers of articles and manuals, and was even used as the title of a magazine, but it never took root. Of 'photogram', it is interesting to note that *photogrammétrique* appears as early as 1768 in the title of J. H. Lambert's report 'La Partie photogrammétrique de l'art du peintre' (Berlin) in the *Mémoires de l'Académie*. Here it refers to the images of the camera obscura for artists.

From philological digression we return to Herschel's communication to the Royal Society, which, strangely, was withdrawn at his own request. We have found proof[27] that this action was taken out of consideration for Talbot, whose achievement Herschel did not wish to belittle by his own independent discovery. Consequently only an abstract of this very important paper was published in the Society's *Proceedings* instead of being printed verbatim in the *Transactions*. Herschel briefly referred to the matter in his next communication of 20 February 1840, in which after recapitulation of the contents of the previous paper, necessitated by its withdrawal, he says, 'of course it will be understood that I have no intention here of interfering with Mr Talbot's just and long antecedent claims'.

This second communication, entitled 'On the chemical action of the rays of the solar spectrum on preparations of silver and other substances, both metallic and non-metallic, and on some photographic processes'[28] abounds in important statements and observations which had a great bearing on the future of photography. Only the most significant can be enumerated here:

1. Herschel stressed the absolute necessity of perfect achromatism in photographic lenses, which he said was one of their three indispensable qualities, the others being flatness of field and sharpness of focus.
2. He introduced the terms 'negative' and 'positive' into photographic nomenclature. (In his previous paper to the Royal Society he had called them 'first and second transfers'. Raoul Rochette had written of 'l'effet positif' in his report on Bayard's direct positive photographs on 2 Nov. 1839.)
3. He described a process for obtaining direct positive photographs on paper (before the publication of Bayard's).
4. Having experimented with photographs on glass, he found that when laid on a black background, or smoked at the back, their character could be changed from negative to positive – a procedure introduced many years later in the ambrotype. He also made positive prints from his glass negatives.
5. Herschel found that bromide of silver was far more light-sensitive than any other silver salt. (Attention to this fact led in all probability to the introduction, by J. F. Goddard, of the accelerating process in the daguerreotype.)
6. He indicated the possibility of photography in natural colours at some future date, having obtained in July 1839 a good colour photograph of the spectrum, without, however, succeeding in fixing the colours.

Herschel was led to the use of glass, first in order to eliminate the organic substances contained in paper (which proved a great inconvenience in all paper processes), and, secondly, for the sake of improved transparency. Though not the first to experiment with photography on glass – Niépce takes precedence in this – Herschel's photograph of his father's famous 40-ft telescope at Slough, taken on 9 September 1839, is the earliest surviving photograph on glass.[29] Herschel deposited a thin film of silver chloride, iodide, or bromide on a glass plate, and just before exposure washed it over with a nitrate of silver solution and exposed it wet, obtaining a visible image in a few seconds in the case of the bromide, which was the most sensitive. Such negatives Pl 39

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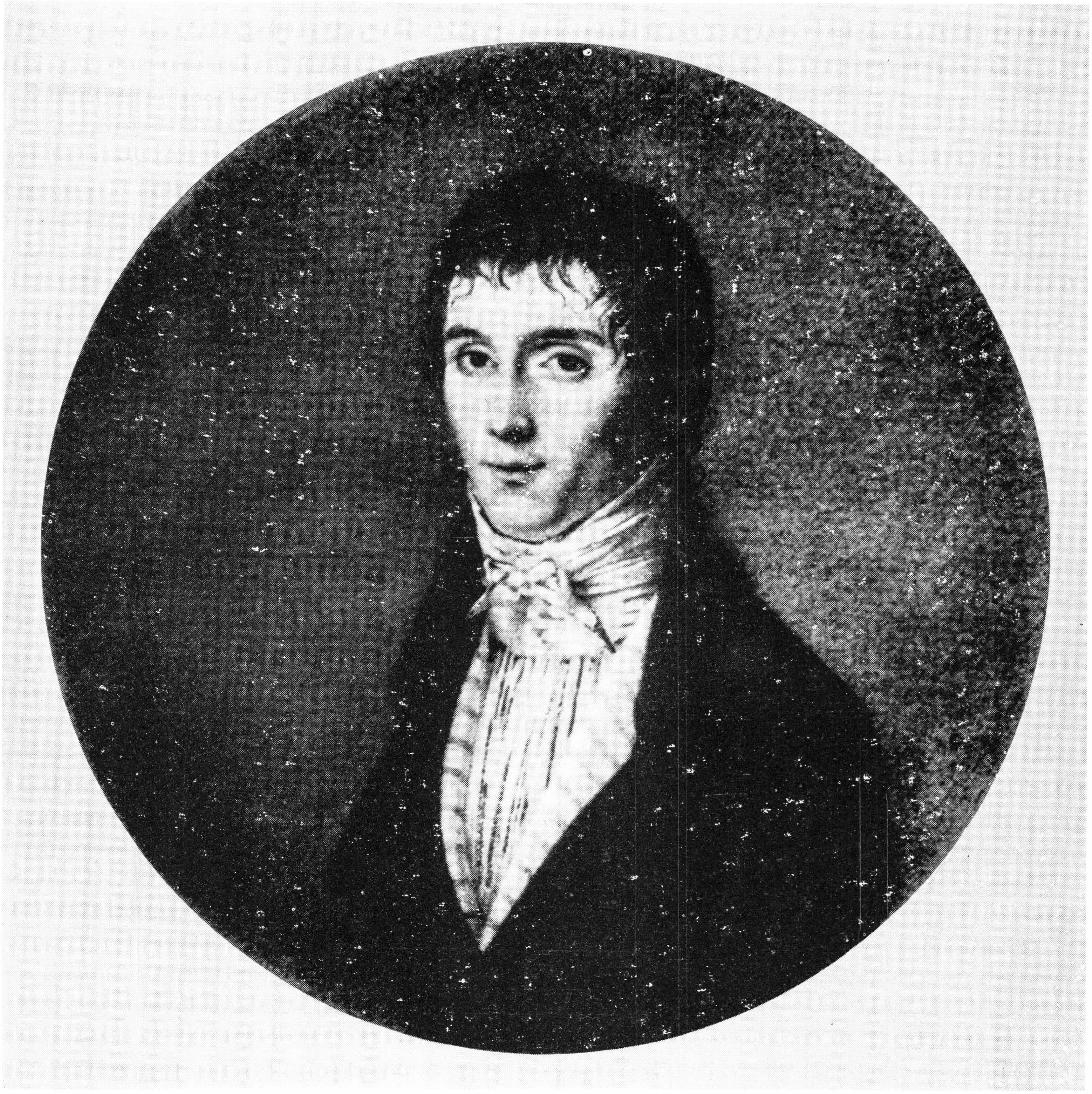
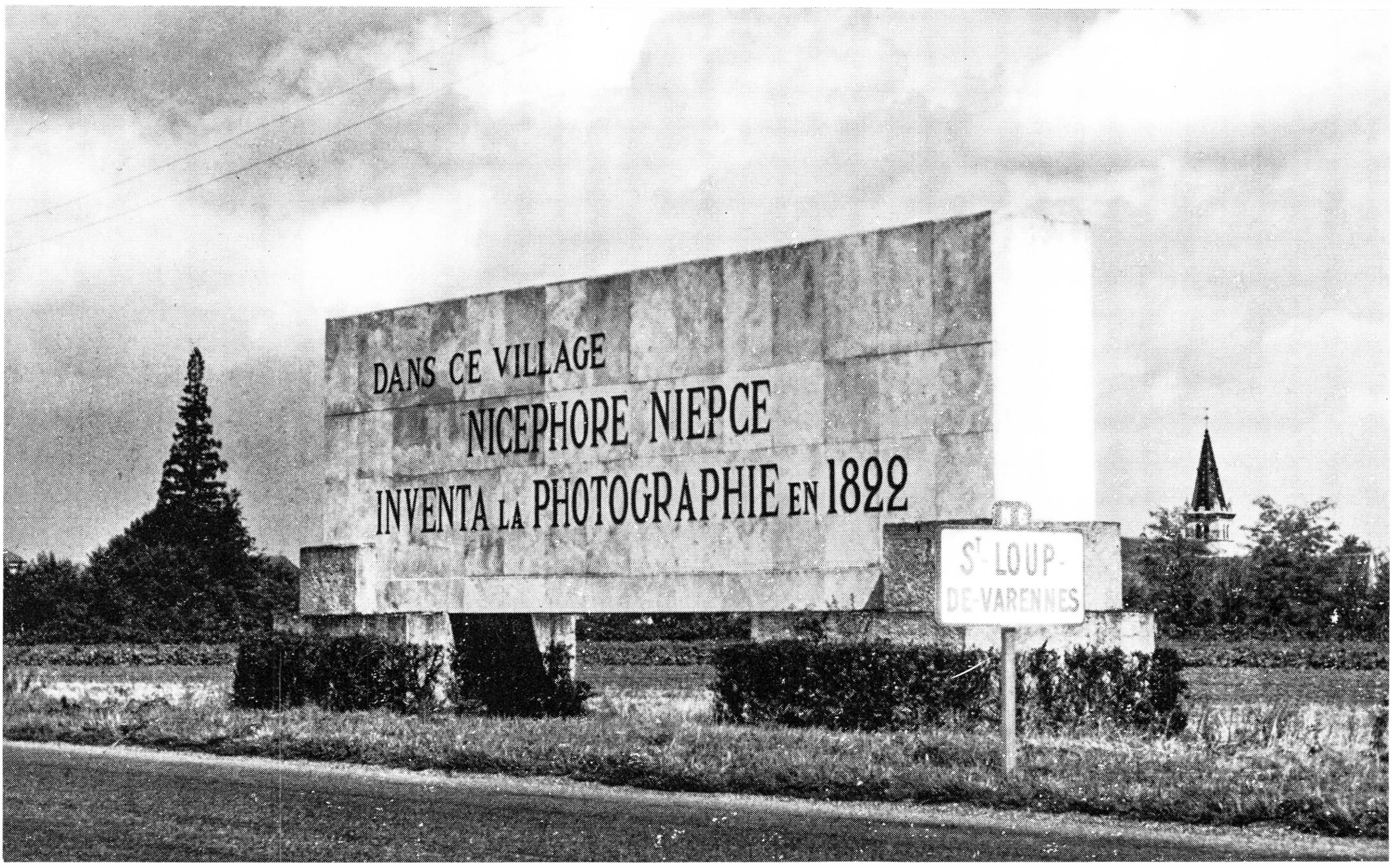
could be used either for printing positives, or they could themselves be made to appear positive by being smoked at the back or mounted on a black background, as in the case of the photograph of the telescope. Professor Alexander Herschel mentions[30] that his father protected several views by framing them behind glass, and mounted them as positive pictures on a dark ground. He also relates that Talbot, visiting his father at the time these glass photographs were produced, was shown a specimen as a step forward in the progress of photography. After examining it carefully, Talbot called it 'the step of a giant'. He had just received from Herschel an account of his process on glass in a letter of 10 September.[31]

In the following years Herschel put forward many suggestions and new proposals which left their mark on photography, and these will be discussed in their appropriate places.

Plates 17–42




DANS CE VILLAGE
NICEPHORE NIEPCE
INVENTA LA PHOTOGRAPHIE EN 1822
St LOUP-DE-VARENNES

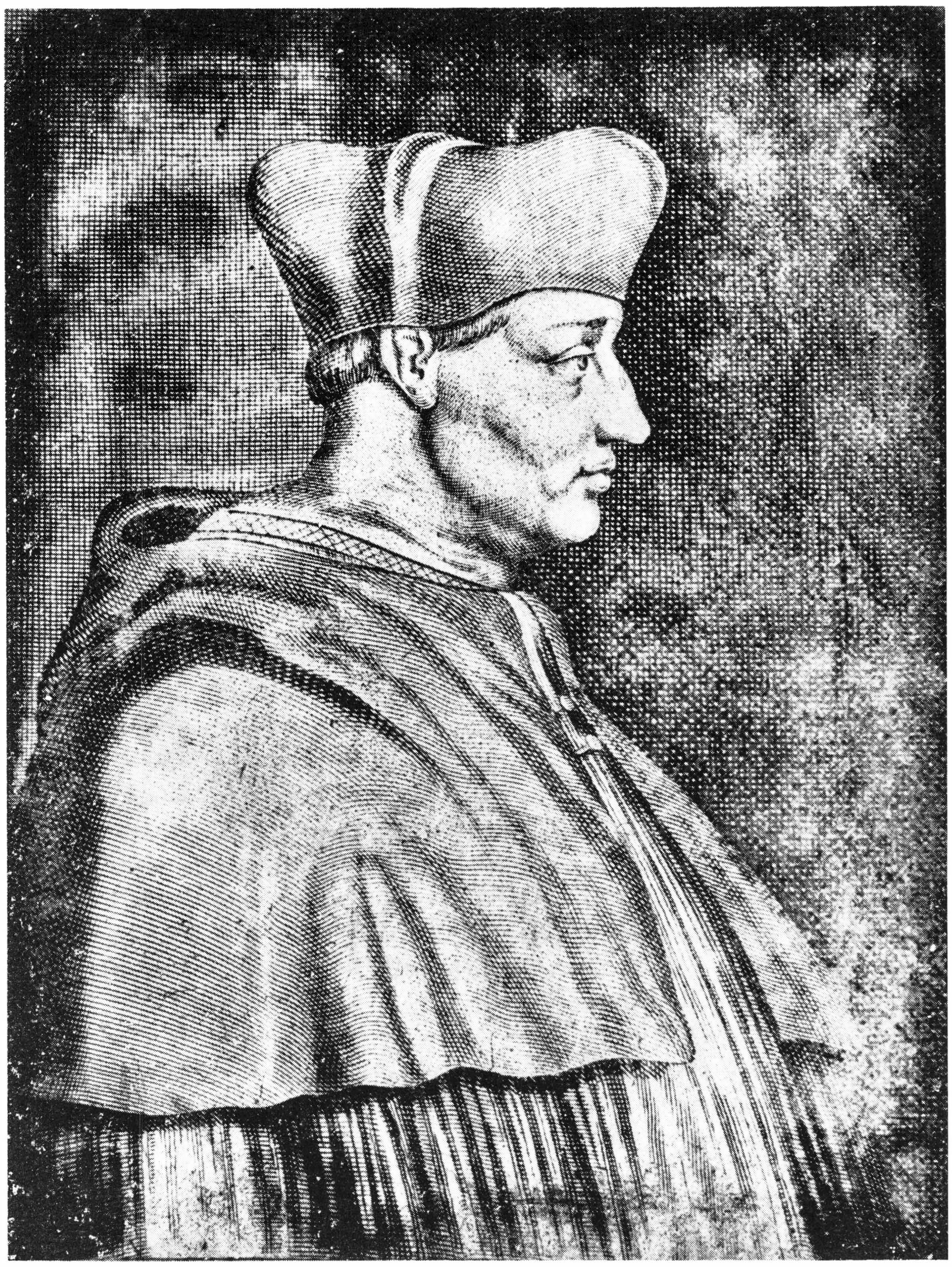
17 NICÉPHORE NÍEPCE. Pencil and wash portrait by C. Laguiche, *c.* 1795

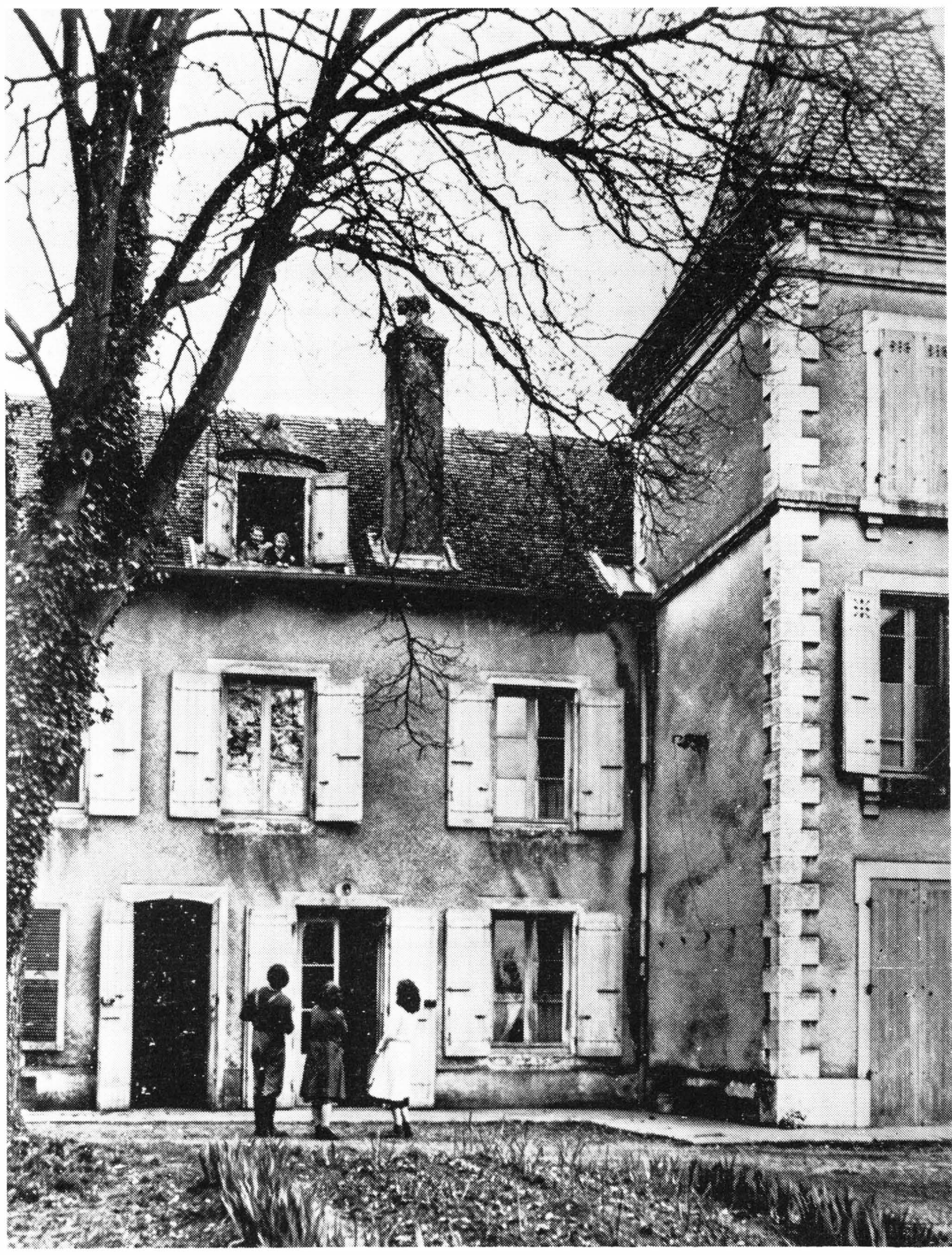
18 Monument to NIÉPCE at Saint-Loup-de-Varennes, erected in 1933

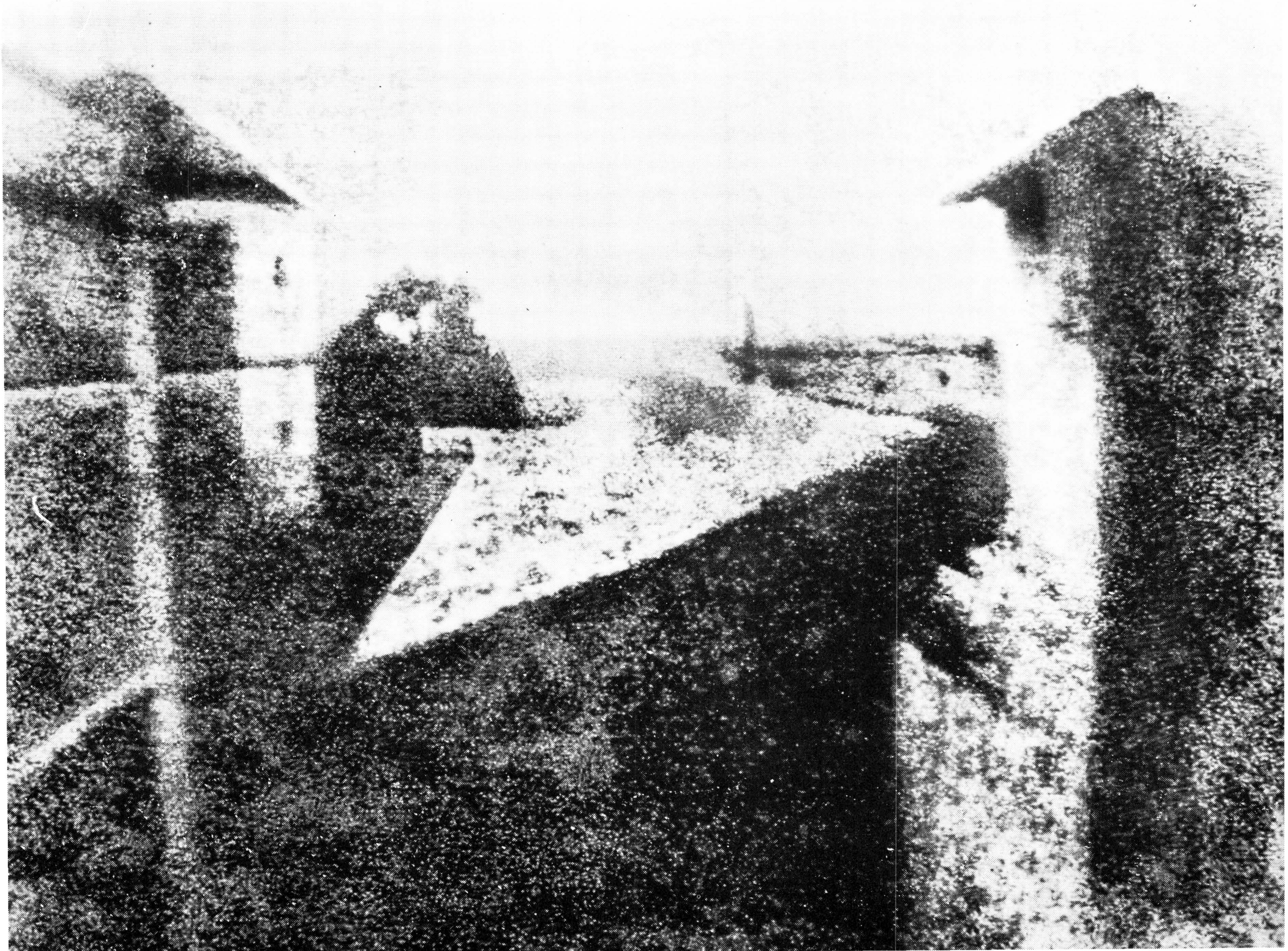
19 Photo-engraving of Cardinal d'Amboise by NICÉPHORE NIÉPCE. Print, $5\frac{1}{2}$ in. × 8 in., pulled in 1827 from plate made in 1826

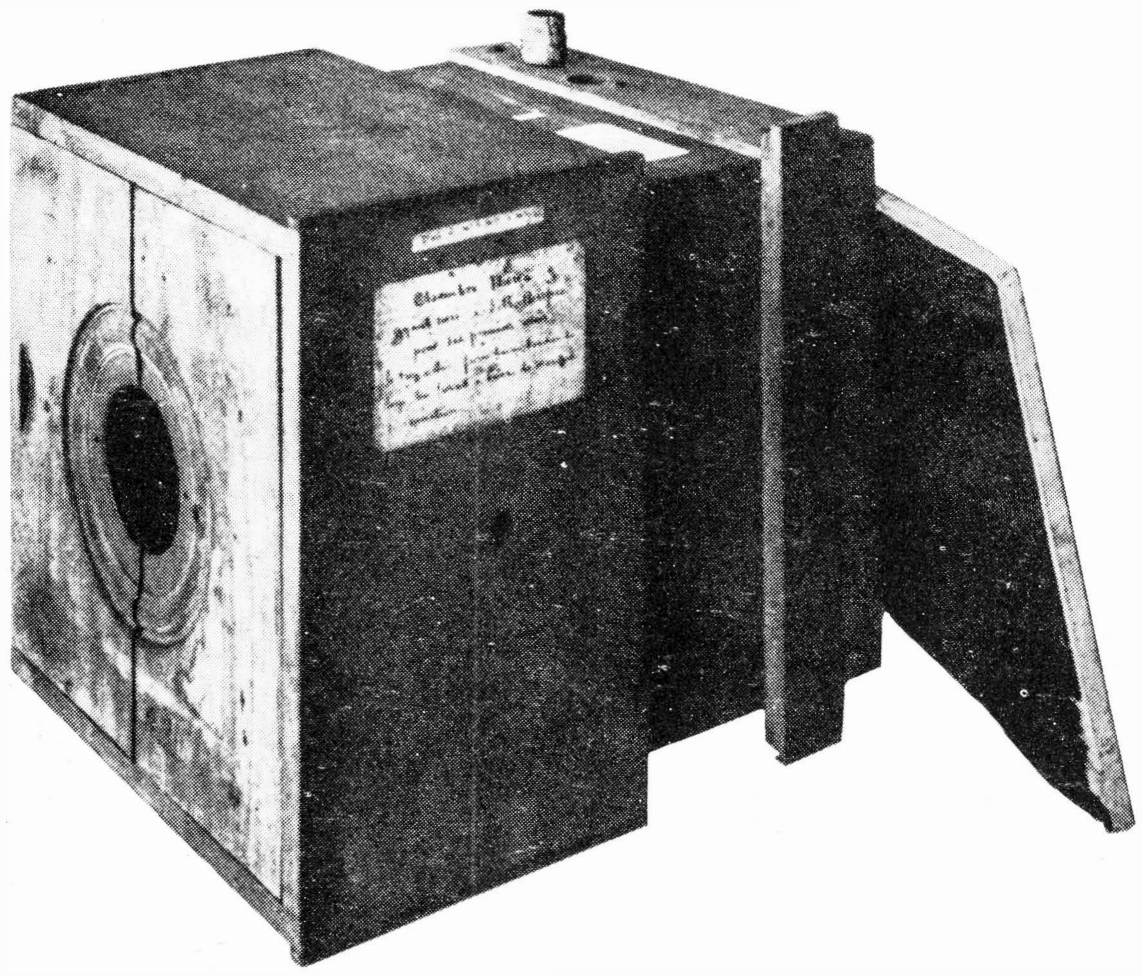
20 Part of Niépce's house, showing the dormer window from which the first photograph was taken. Photograph taken in 1952

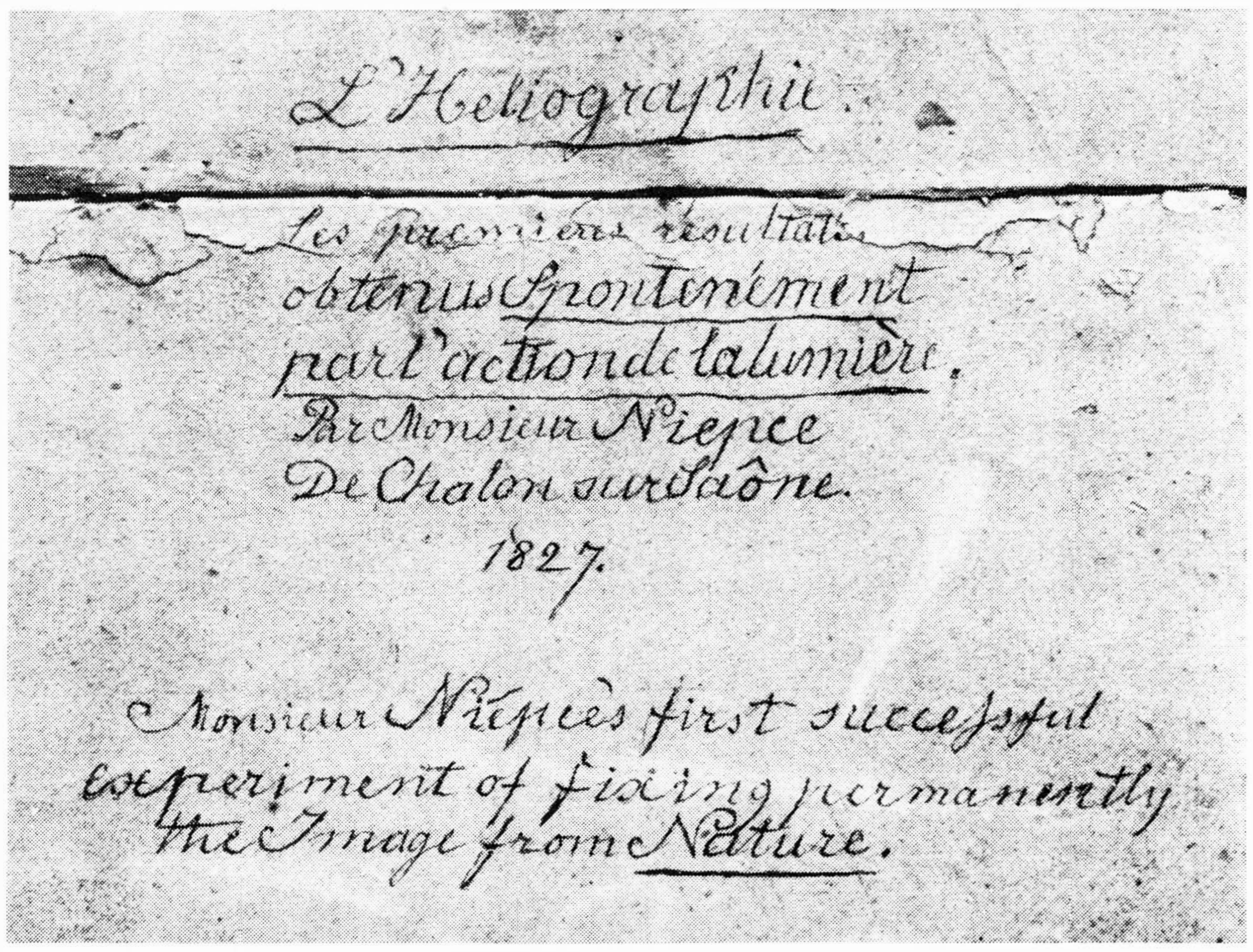
21 The world's first photograph, by NICÉPHORE NIÉPCE. View from his window at Gras, 8 in. × $6\frac{1}{2}$ in.







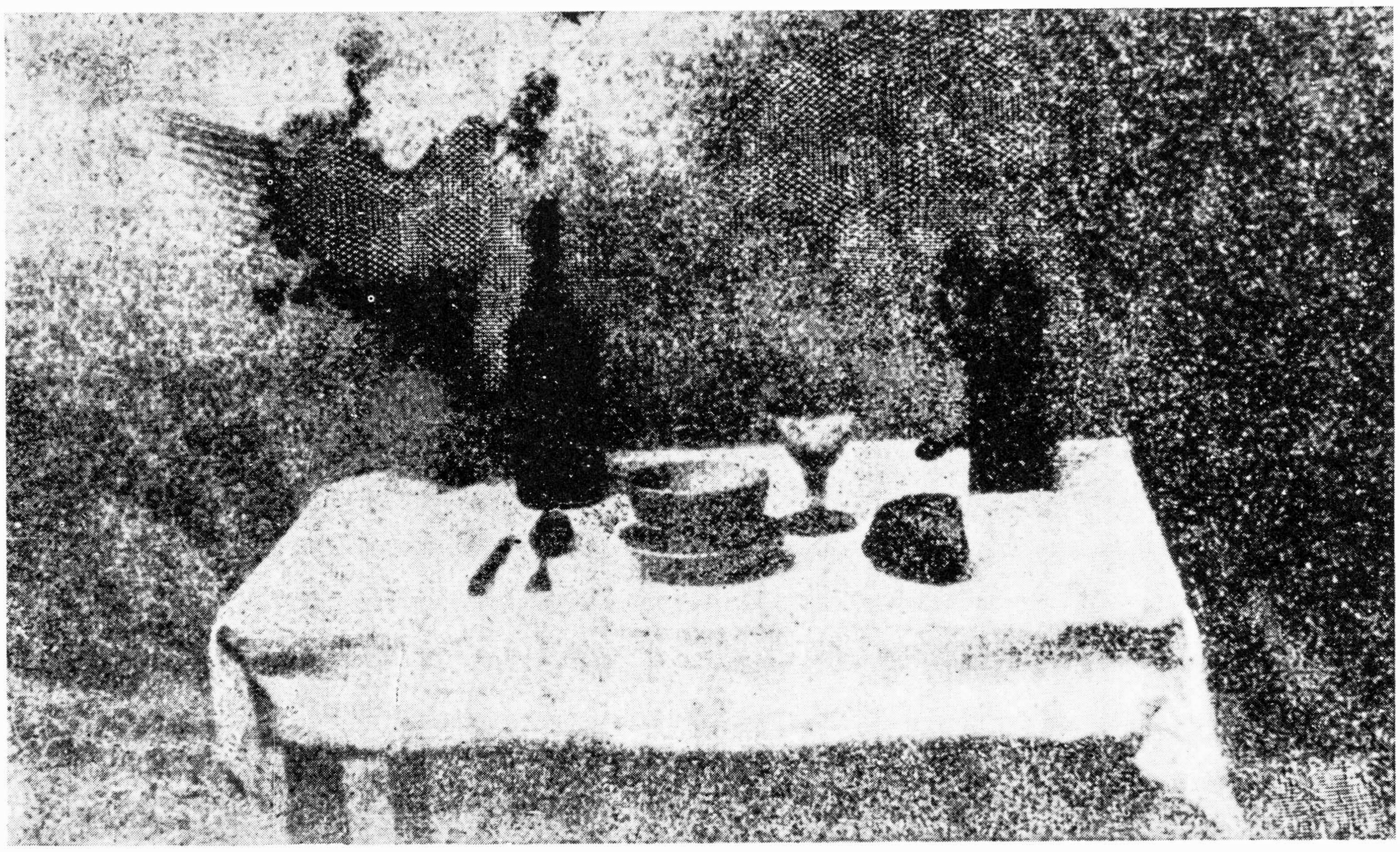




L'Heliographie

Les premiers résultats
obtenus Spontanément
par l'action de la lumière.
Par Monsieur Niepce
De Chalon sur Saône.
1827.

Monsieur Niépce's first successful
experiment of fixing permanently
the Image from Nature.

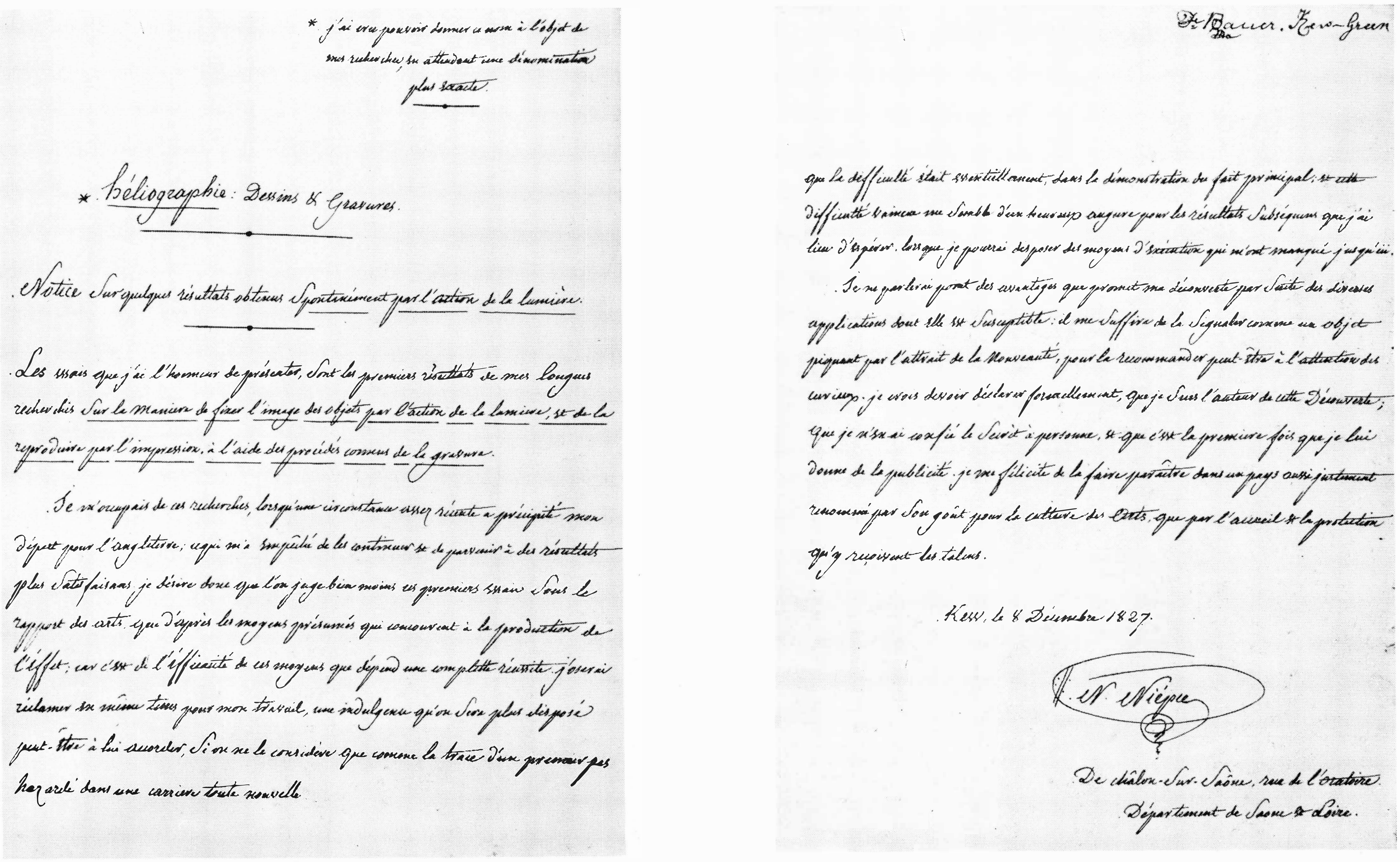


22 One of NIÉPCE's cameras, at Musée Denon, Chalon-sur-Saône

23 Label on back of NIÉPCE's first photograph

24 A table laid for a meal. Photograph on glass by NIEPCE, often mistakenly called his first photograph. Probably 1829. Reproduction at Société Française de Photographie, Paris

25 Beginning and end of Niépce's memoir to the Royal Society, 1827



* j'ai cru pouvoir donner ce nom à l'objet de mes recherches, en attendant une dénomination plus exacte.

* Héliographie: Dessins & Gravures.

Notice Sur quelques résultats obtenus Spontanément par l'action de la lumière.

Les essais que j'ai l'honneur de présenter, Sont les premiers résultats de mes longues recherches Sur la Manière de fixer l'image des objets par l'action de la lumière, et de la reproduire par l'impression, à l'aide des procédés connus de la gravure.

Je m'occupais de ces recherches, lorsqu'une circonstance assez récente a précipité mon départ pour l'angleterre; ce qui m'a empêché de les continuer et de parvenir à des résultats plus Satisfaisans. je désire donc que l'on juge bien moins ces premiers essais Sous le rapport des arts, que d'après les moyens présumés qui concourent à la production de l'effet; car c'est de l'efficacité de ces moyens que dépend une complette réussite. j'oserai réclamer en même tems pour mon travail, une indulgence qu'on Sera plus disposé peut-être à lui accorder, Si on ne le considère que comme la trace d'un premier pas hazardé dans une carrière toute nouvelle.

Fr. Bauer. Kew-Green

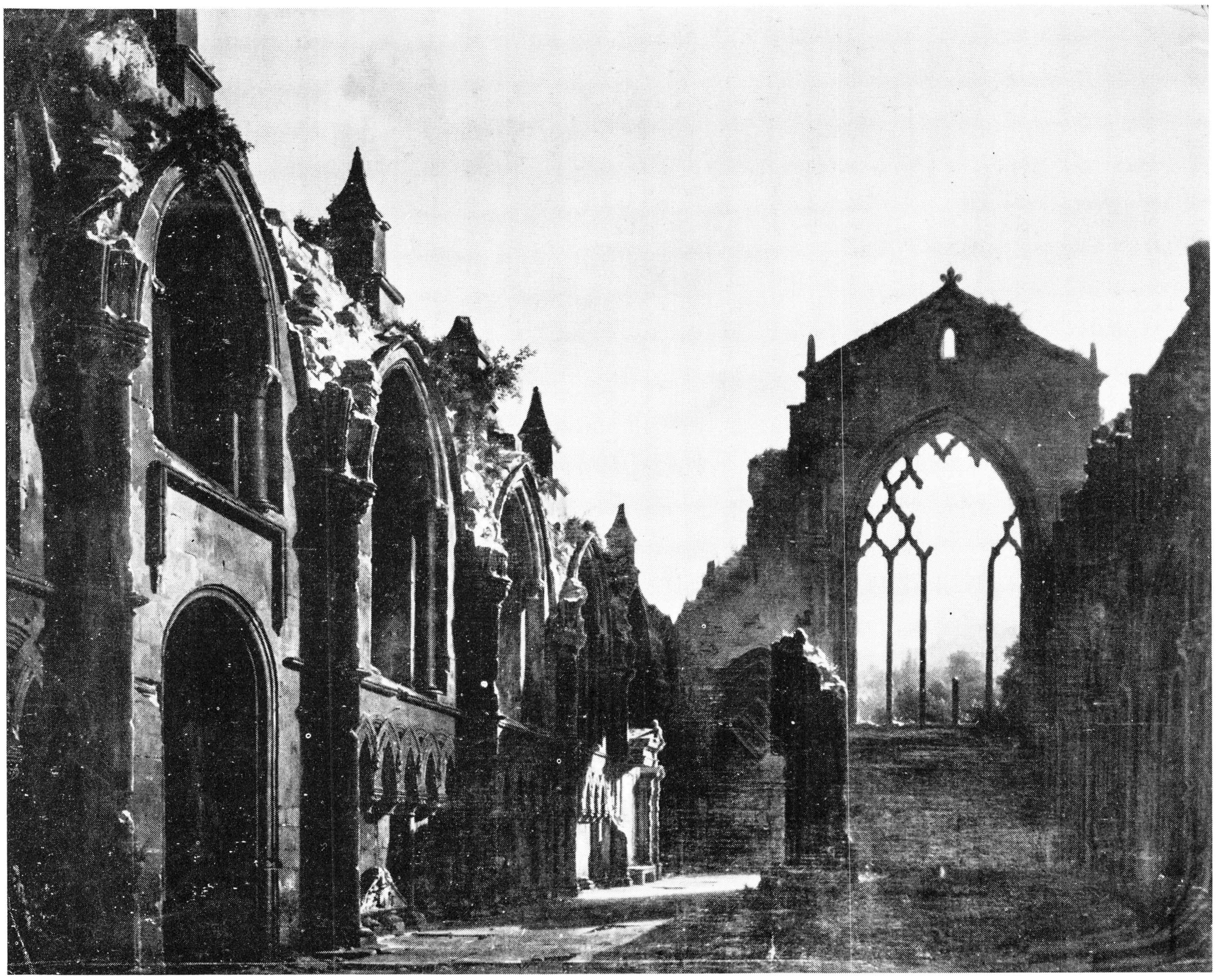
que la difficulté était essentiellement, dans la démonstration du fait principal: et cette difficulté vaincue me Semble d'un heureux augure pour les résultats Subséquens que j'ai lieu d'espérer, lorsque je pourrai disposer des moyens d'exécution qui m'ont manqué jusqu'ici.

Je ne parlerai point des avantages que promet ma découverte par Suite des diverses applications dont elle est Susceptible: il me Suffira de la Signaler comme un objet piquant par l'attrait de la Nouveauté, pour la recommander peut-être à l'attention des curieux. je crois devoir déclarer formellement, que je Suis l'auteur de cette Découverte; Que je n'en ai confié le Secret à personne, et que c'est la première fois que je lui donne de la publicité. je me félicite de la faire paraître dans un pays aussi justement renommé par Son goût pour la culture des Arts, que par l'accueil et la protection qu'y reçoivent les talens.

Kew, le 8 Décembre 1827.

J. N. Niépce

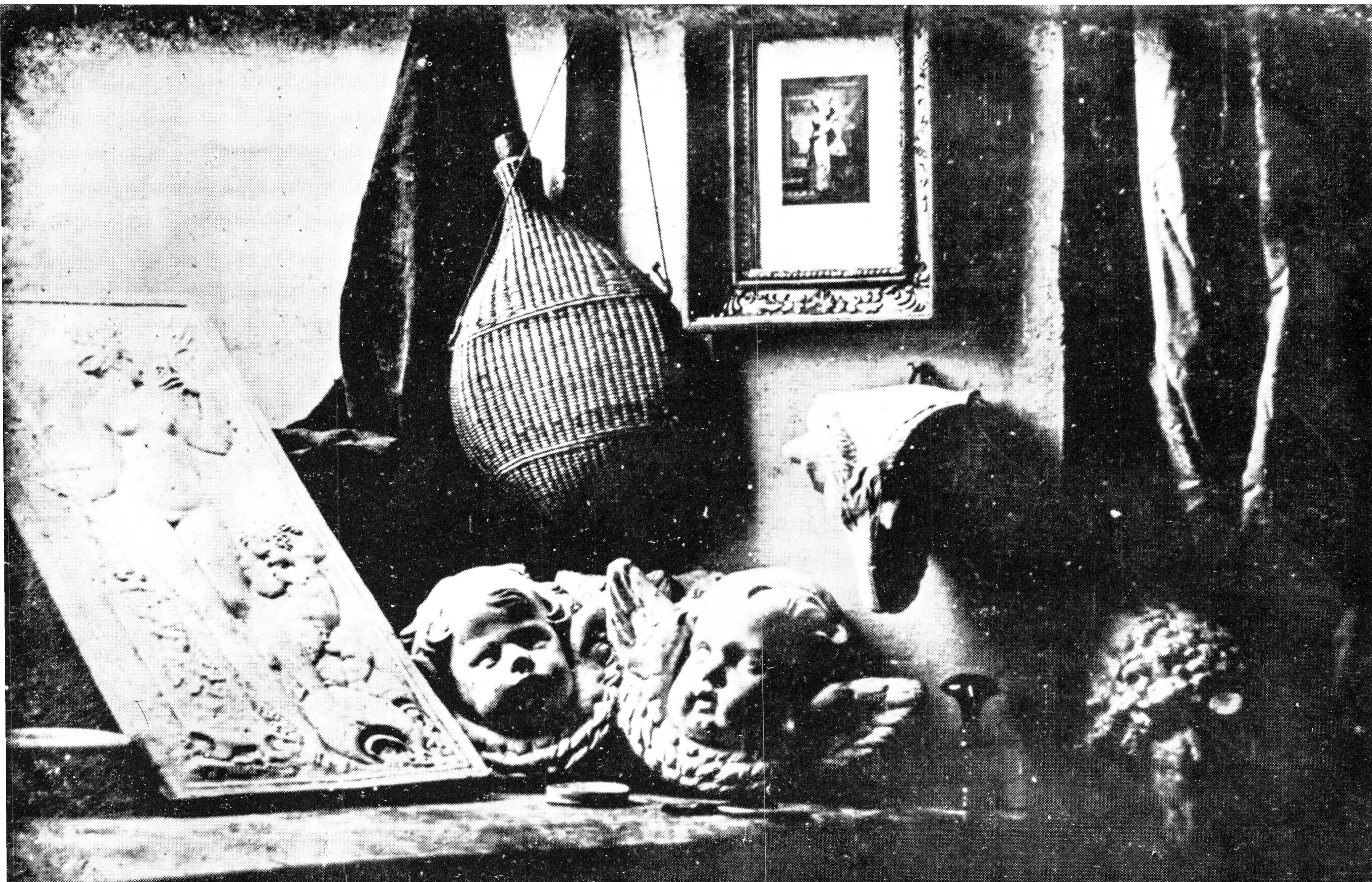
De châlon-Sur-Saône, rue de l'oratoire.
Département de Saone et Loire.

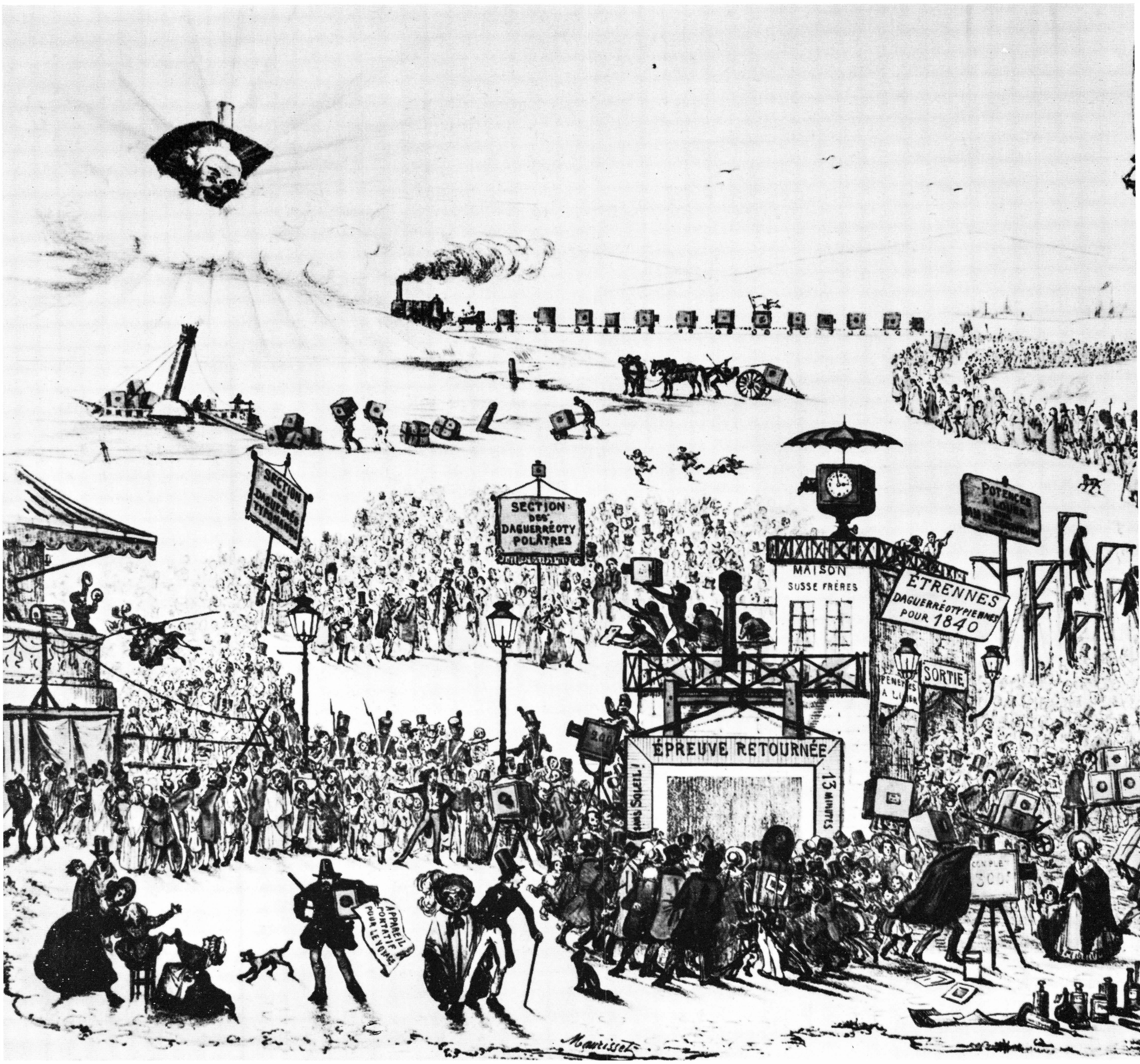


26 Holyrood Chapel, Edinburgh. Oil painting by DAGUERRE, 1824, now in the Walker Art Gallery, Liverpool

27 Earliest extant daguerreotype by DAGUERRE, 1837. Original at the Société Française de Photographie, Paris

28 L. J. M. DAGUERRE. Daguerreotype by J. E. MAYALL, 1848

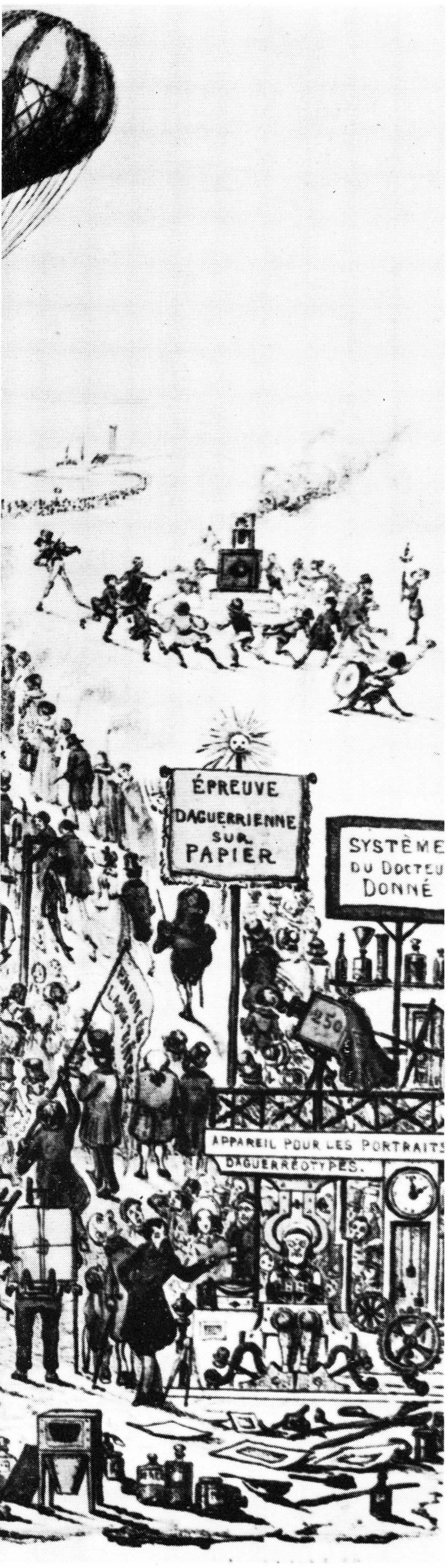


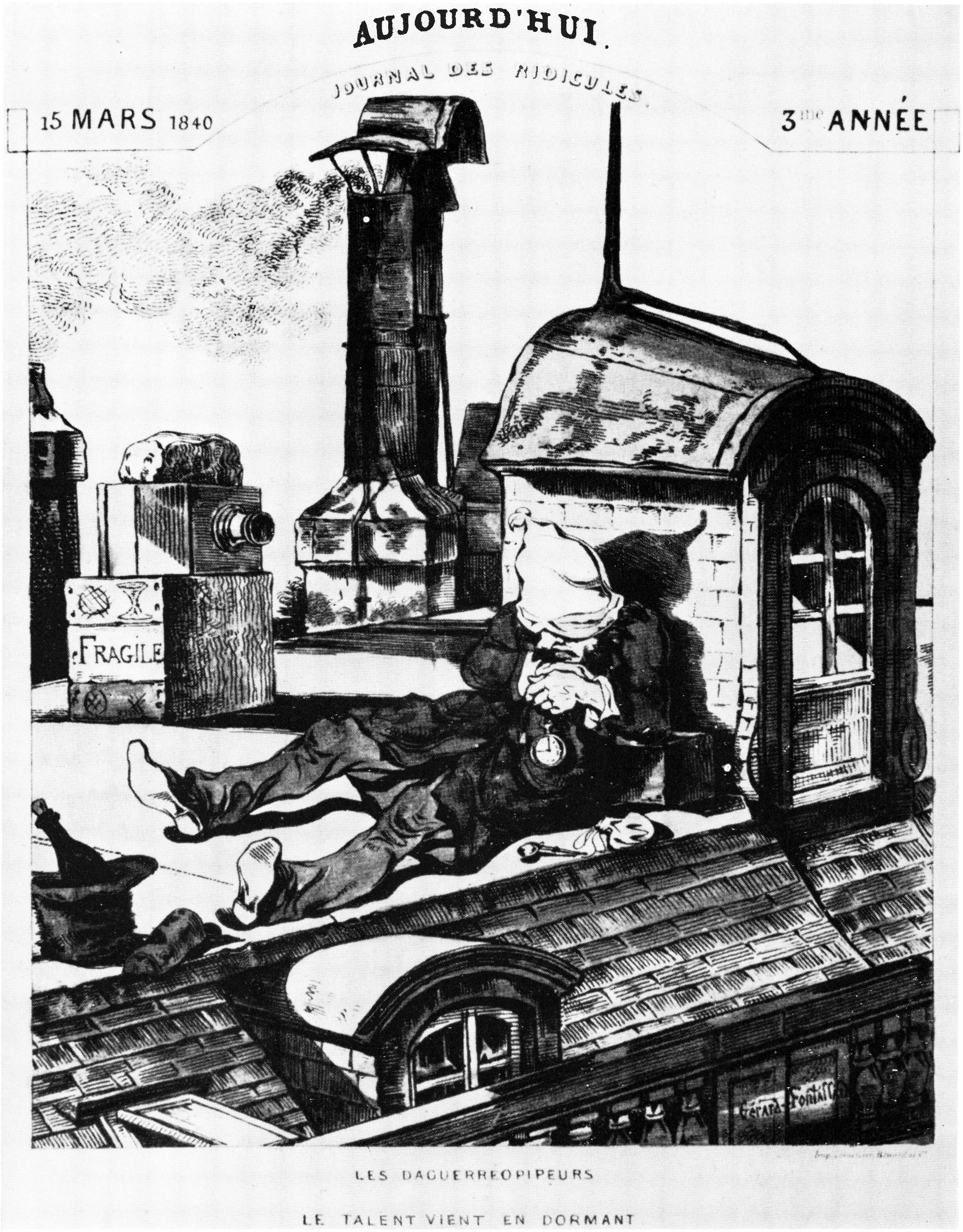

SECTION DES DAGUERRÉOTYPEURS
SECTION DES DAGUERRÉOTY POLÂTRES
MAISON SUSSE FRÈRES
ÉTRENNES DAGUERRÉOTYPIENNES POUR 1840
POTENCES A LOUER
SORTIE
POTENCES A LOUER
ÉPREUVE RETOURNÉE
13 MINUTES
SANS SOLEIL!
APPAREIL PORTATIF POUR LE VOYAGE
COMPLET 300F
Maurisset

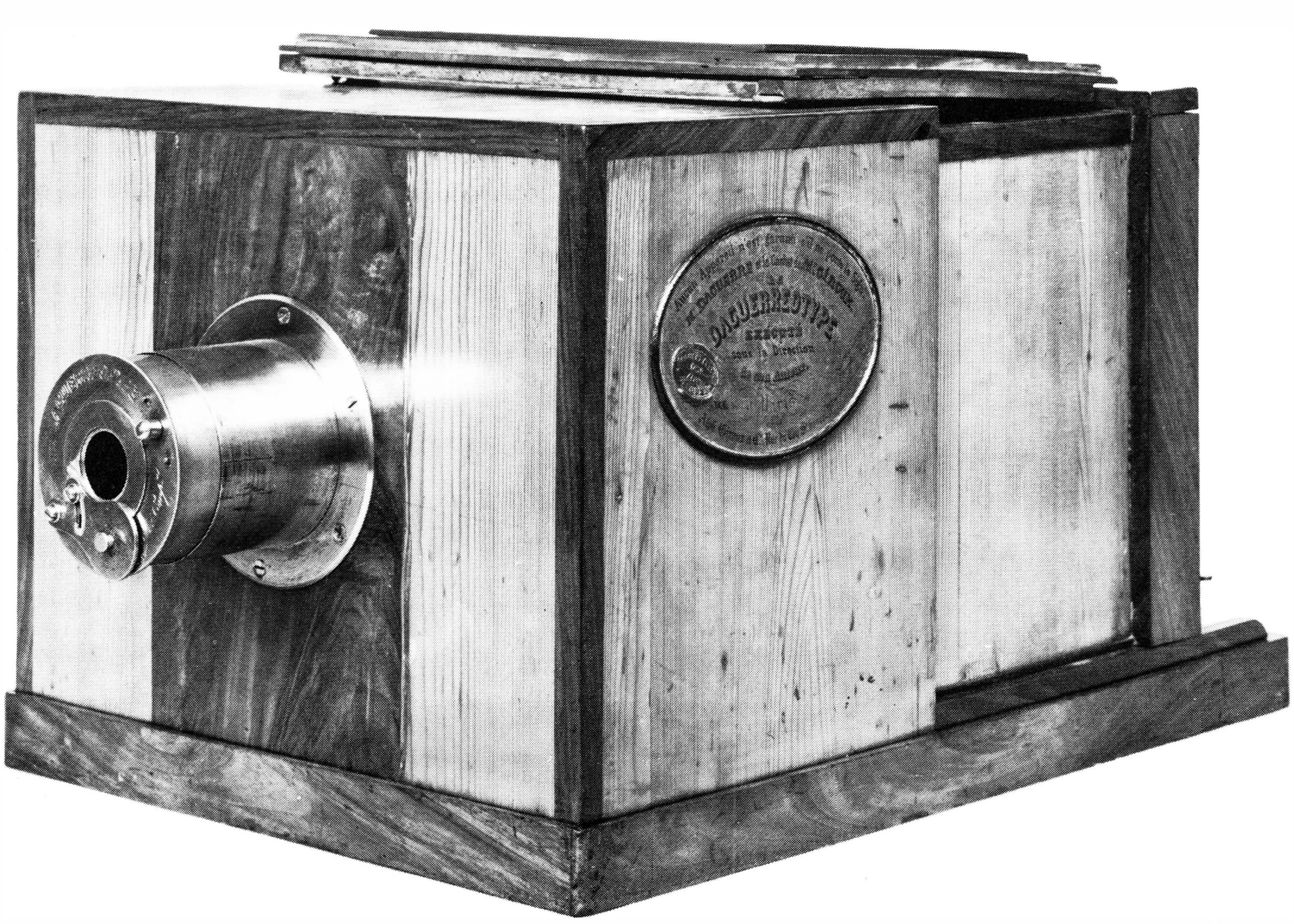
29 'Daguerréotypomanie', caricature by Theodore Maurisset, December 1839

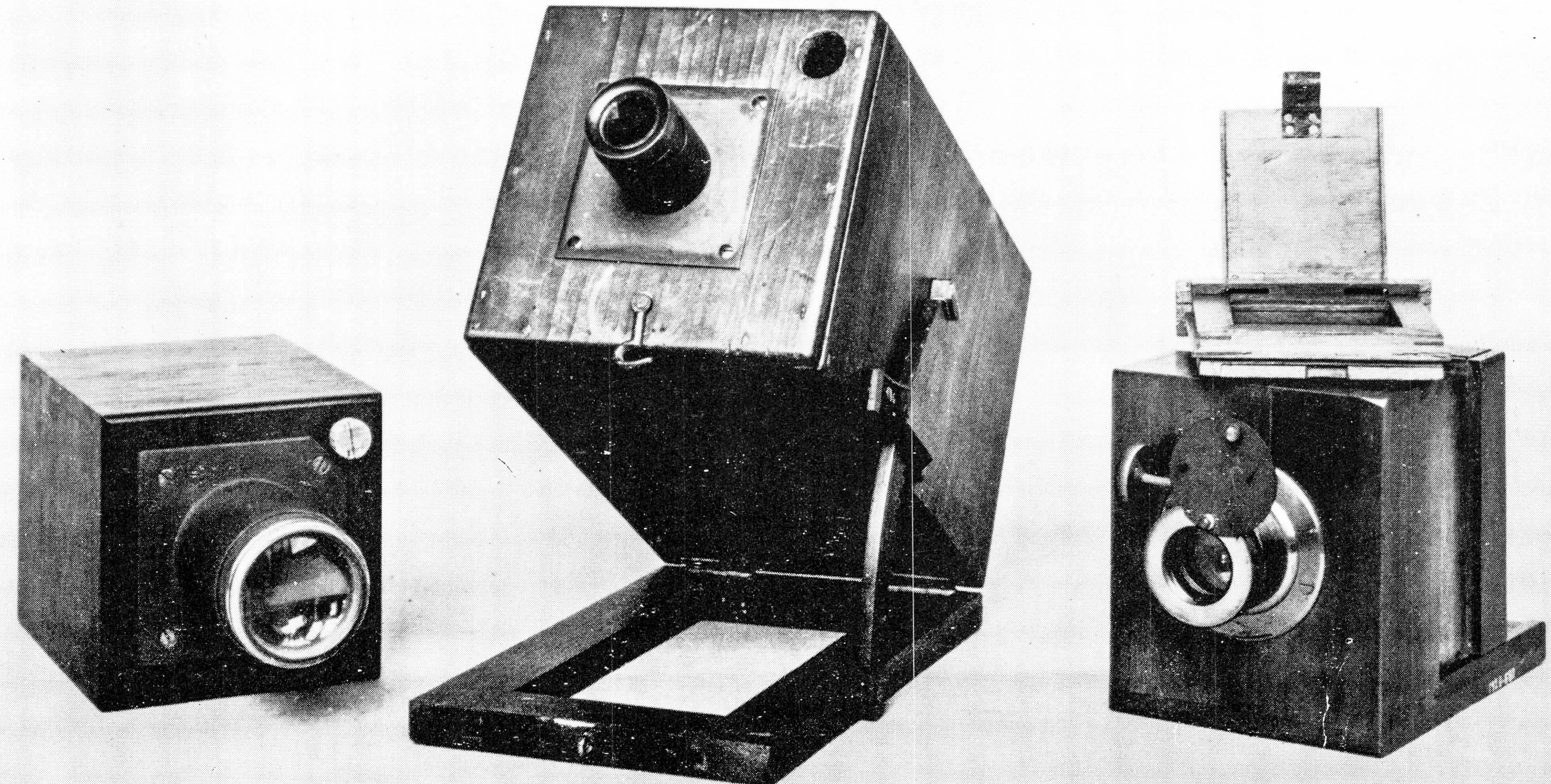
30 'Le Talent vient en dormant', caricature by Gérard Fontallard, from *Aujourd'hui*, 15 March 1840

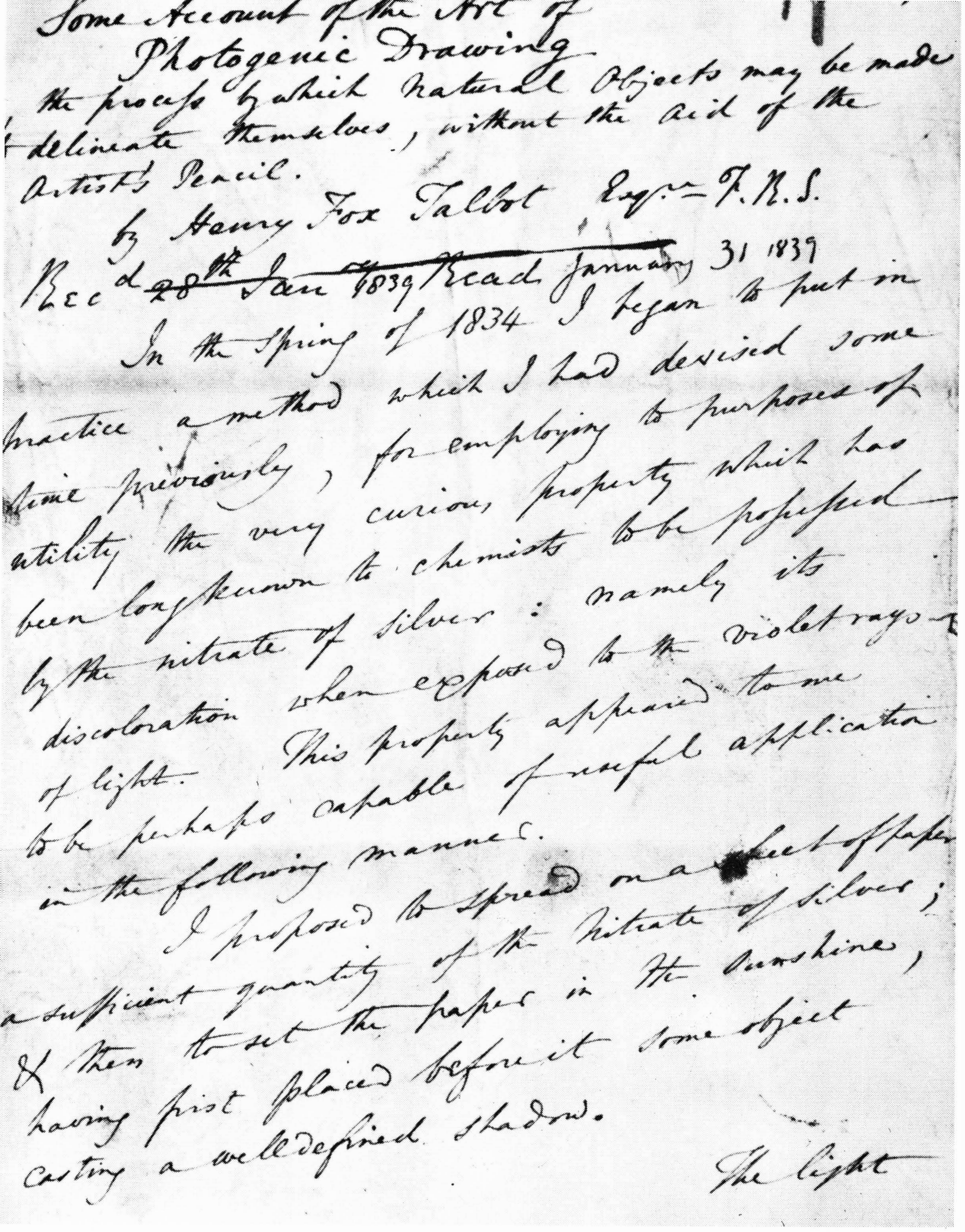
31 Daguerre camera made by GIROUX, 1839. Science Museum, London


ÉPREUVE DAGUERRIENNE SUR PAPIER
SYSTÈME DU DOCTEU DONNÉ
250
APPAREIL POUR LES PORTRAITS
DAGUERRÉOTYPES.


AUJOURD'HUI.
JOURNAL DES RIDICULES.
15 MARS 1840
3me ANNÉE
FRAGILE
Gérard-Portraits
LES DAGUERREOPIPEURS
LE TALENT VIENT EN DORMANT


DAGUERRÉOTYPE
EXÉCUTÉ
sous la Direction



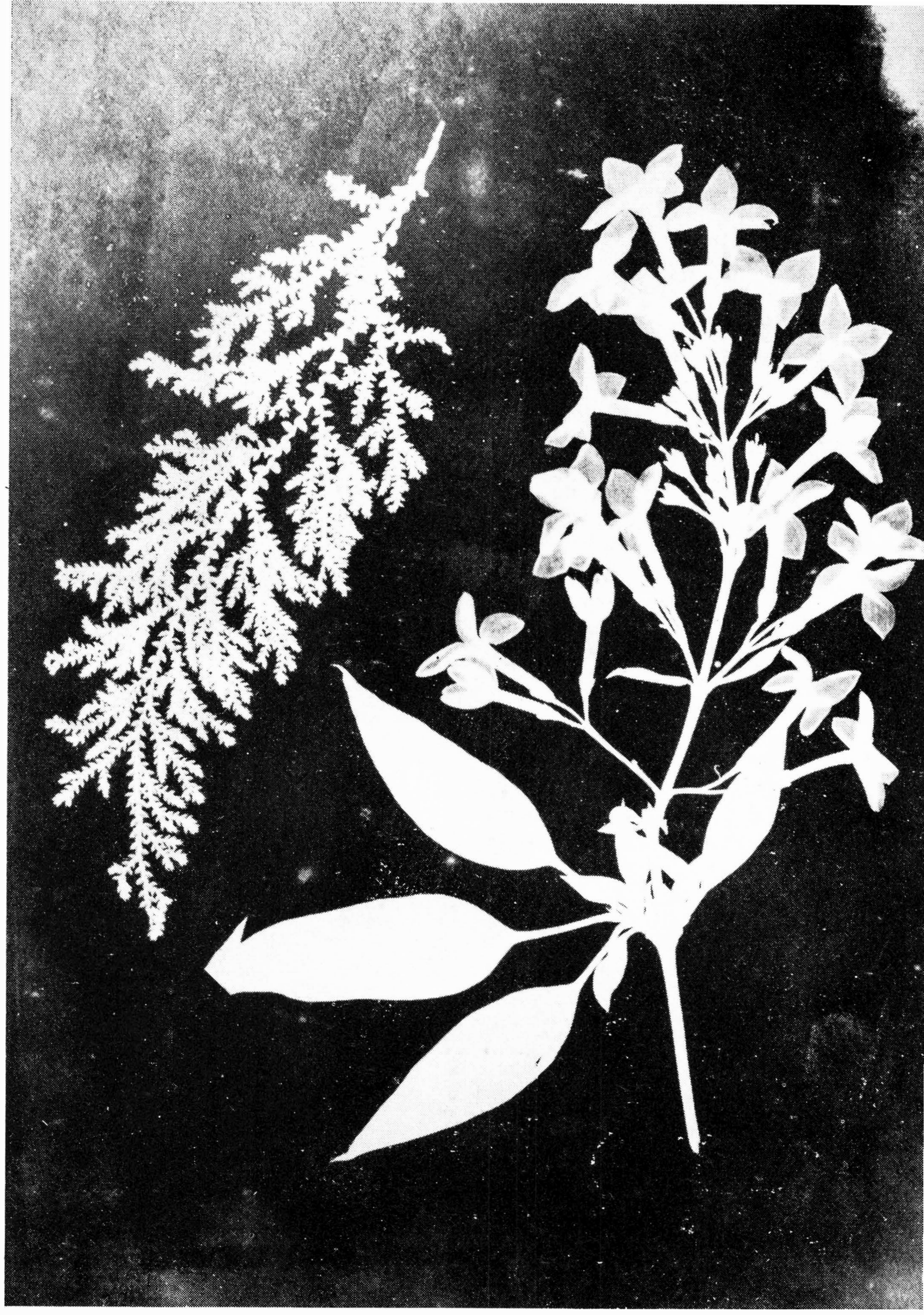


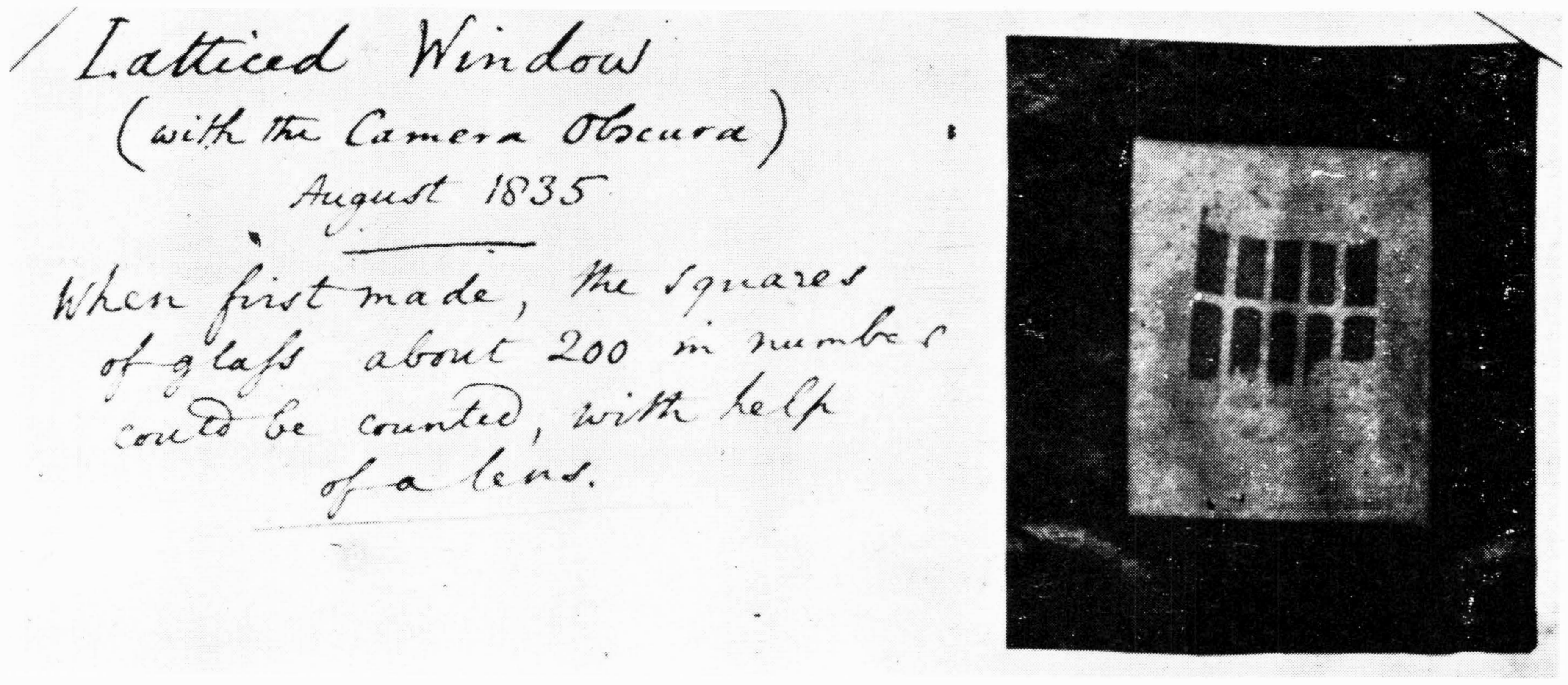
Some Account of the Art of
Photogenic Drawing
the process by which Natural Objects may be made
delineate themselves, without the aid of the
Artist's Pencil.
by Henry Fox Talbot Esqre – F.R.S.
Recd ~~28th Jan 1839~~ Read January 31 1839

In the Spring of 1834 I began to put in
practice a method which I had devised some
time previously, for employing to purposes of
utility the very curious property which has
been long known to chemists to be possessed
by the nitrate of silver: namely its
discoloration when exposed to the violet rays
of light. This property appeared to me
to be perhaps capable of useful application
in the following manner.

I proposed to spread on a sheet of paper
a sufficient quantity of the nitrate of silver;
& then to set the paper in the sunshine,
having first placed before it some object
casting a welldefined shadow.

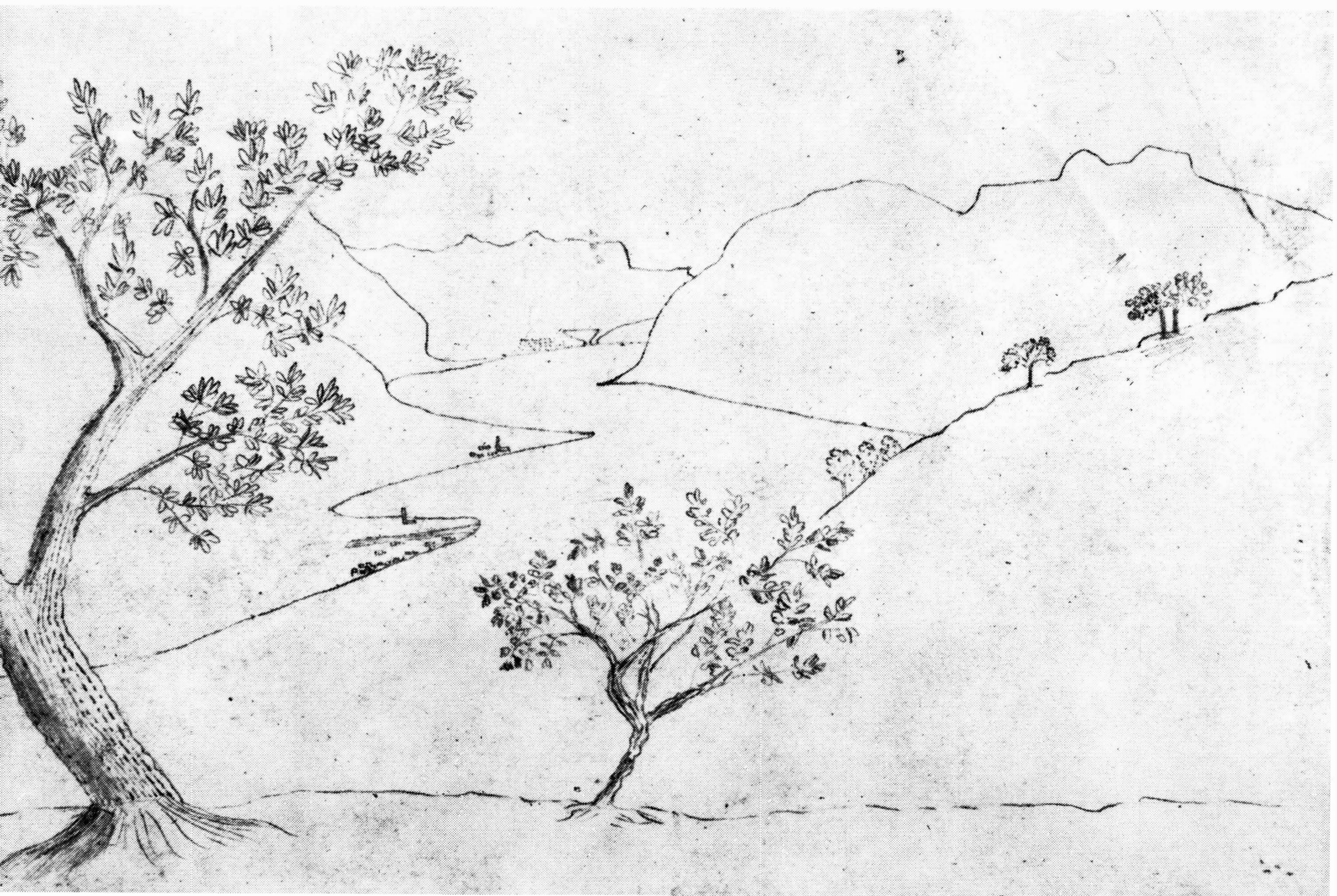
The light





Latticed Window
(with the Camera Obscura)
August 1835

When first made, the squares
of glass about 200 in number
could be counted, with help
of a lens.



32 FOX TALBOT. Daguerreotype by ANTOINE CLAUDET, 1844

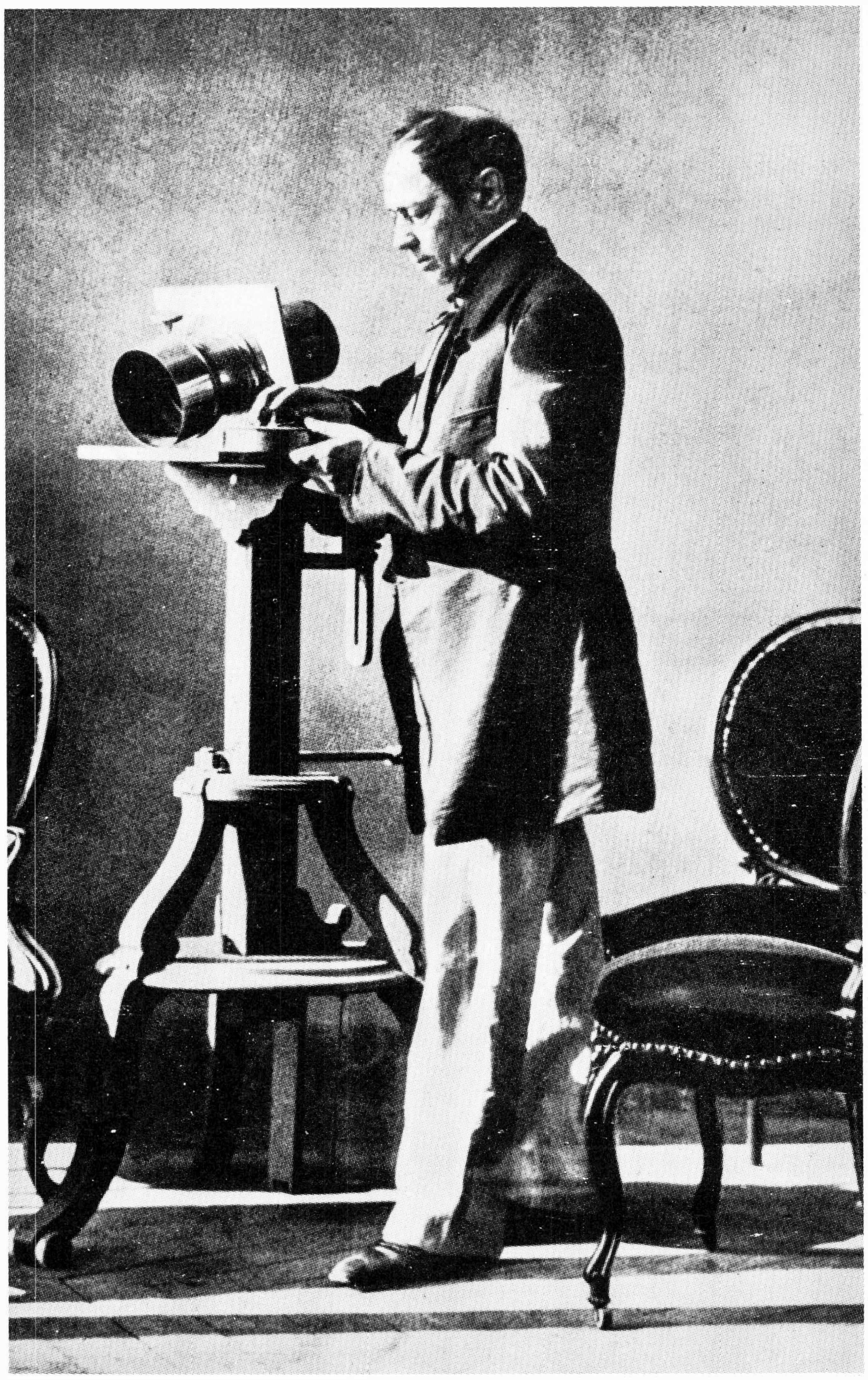
33 Three of TALBOT's cameras for Photogenic Drawing and for the Calotype process, *c.* 1841, now in the Science Museum, London

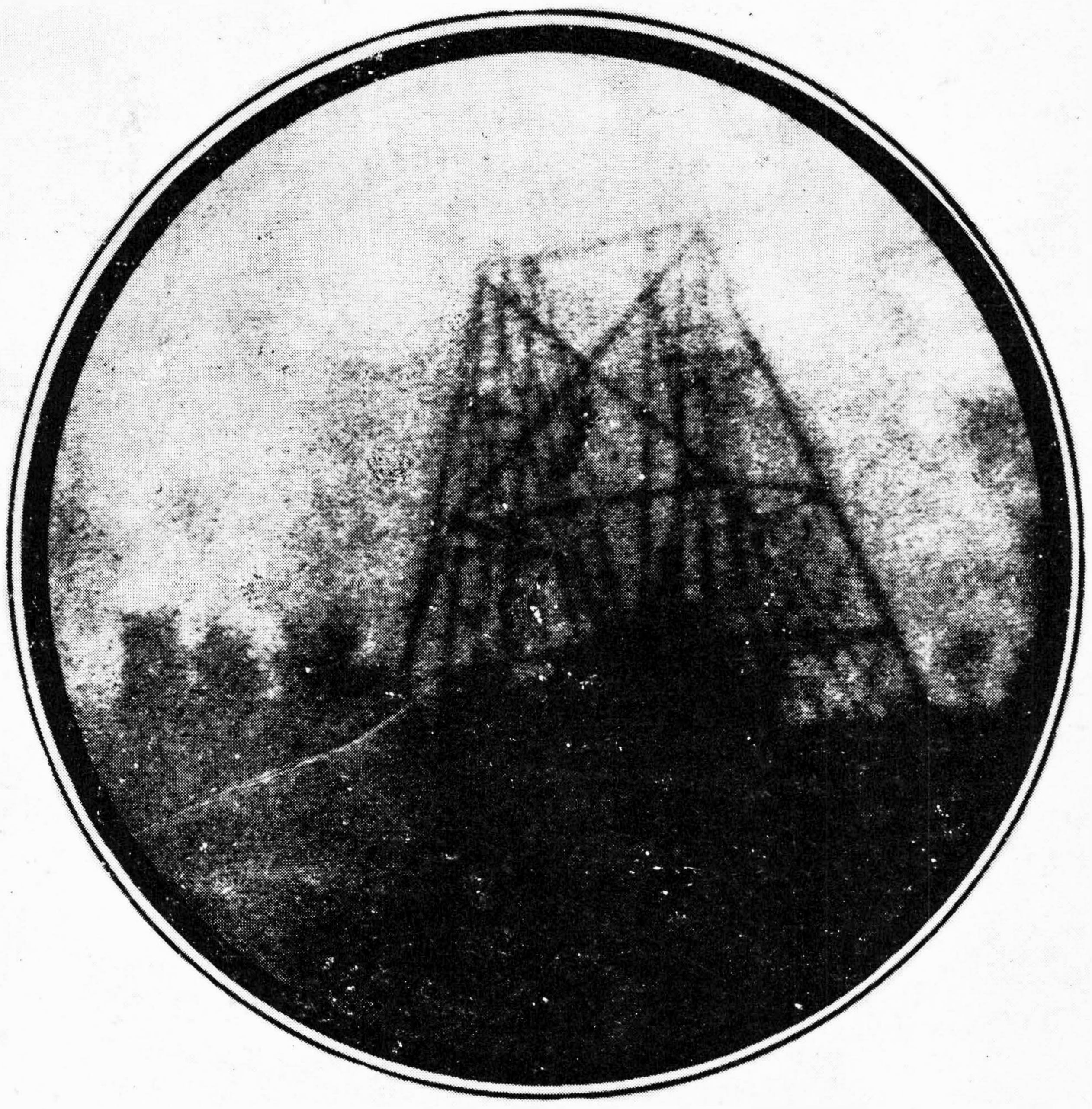
34 FOX TALBOT's manuscript 'Some Account of the Art of Photogenic Drawing', 31 January 1839, now in the archives of the Royal Society, London

35 FOX TALBOT. Photogenic drawing of jasmine and fern, 1839

36 FOX TALBOT's earliest surviving paper negative: latticed window at Lacock Abbey, 1835. 1 in. square. Original at Science Museum, London

37 FOX TALBOT. Sketch made with the camera lucida at Bellagio, October 1833. From the collection of the Royal Photographic Society, London



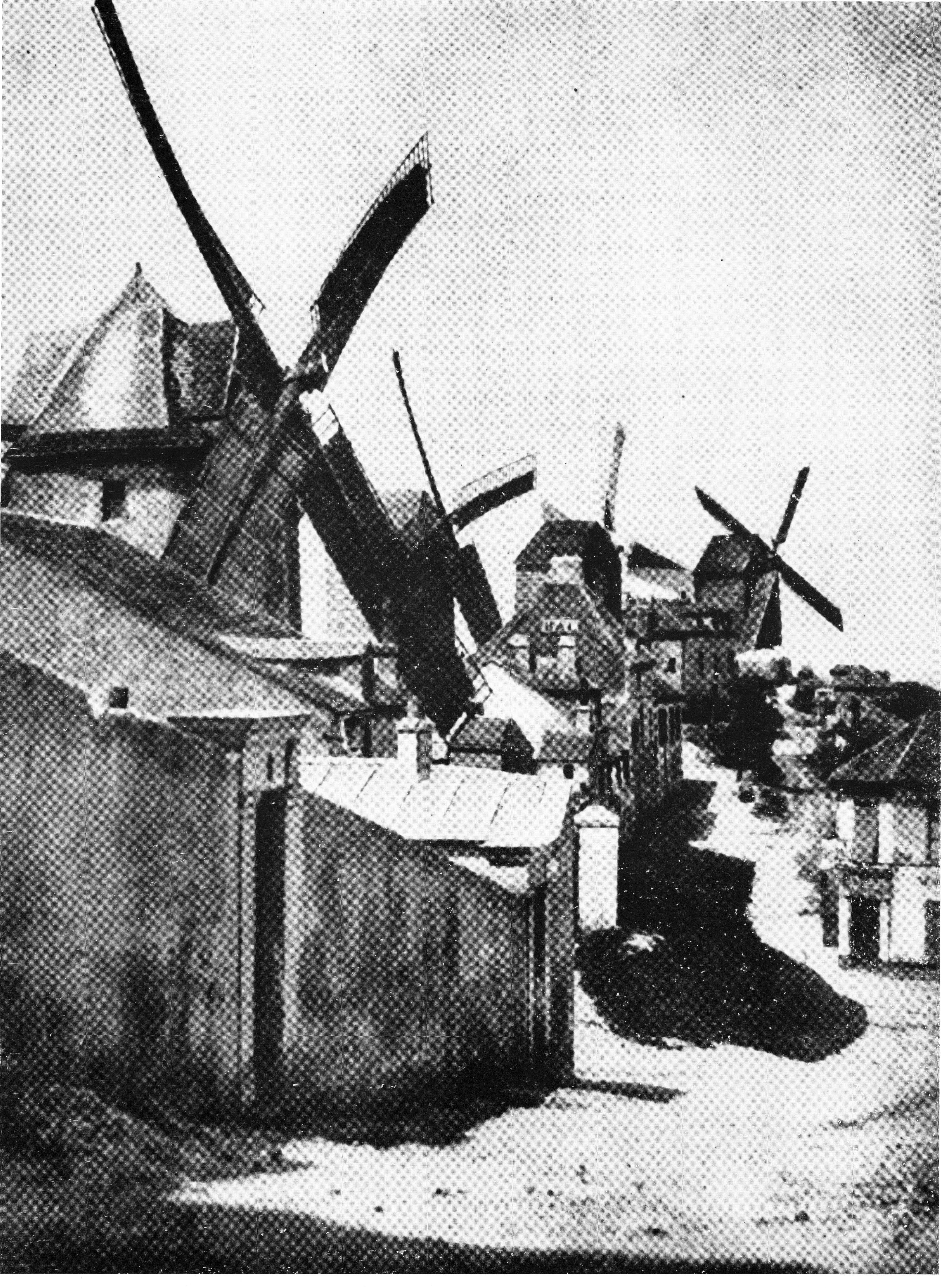


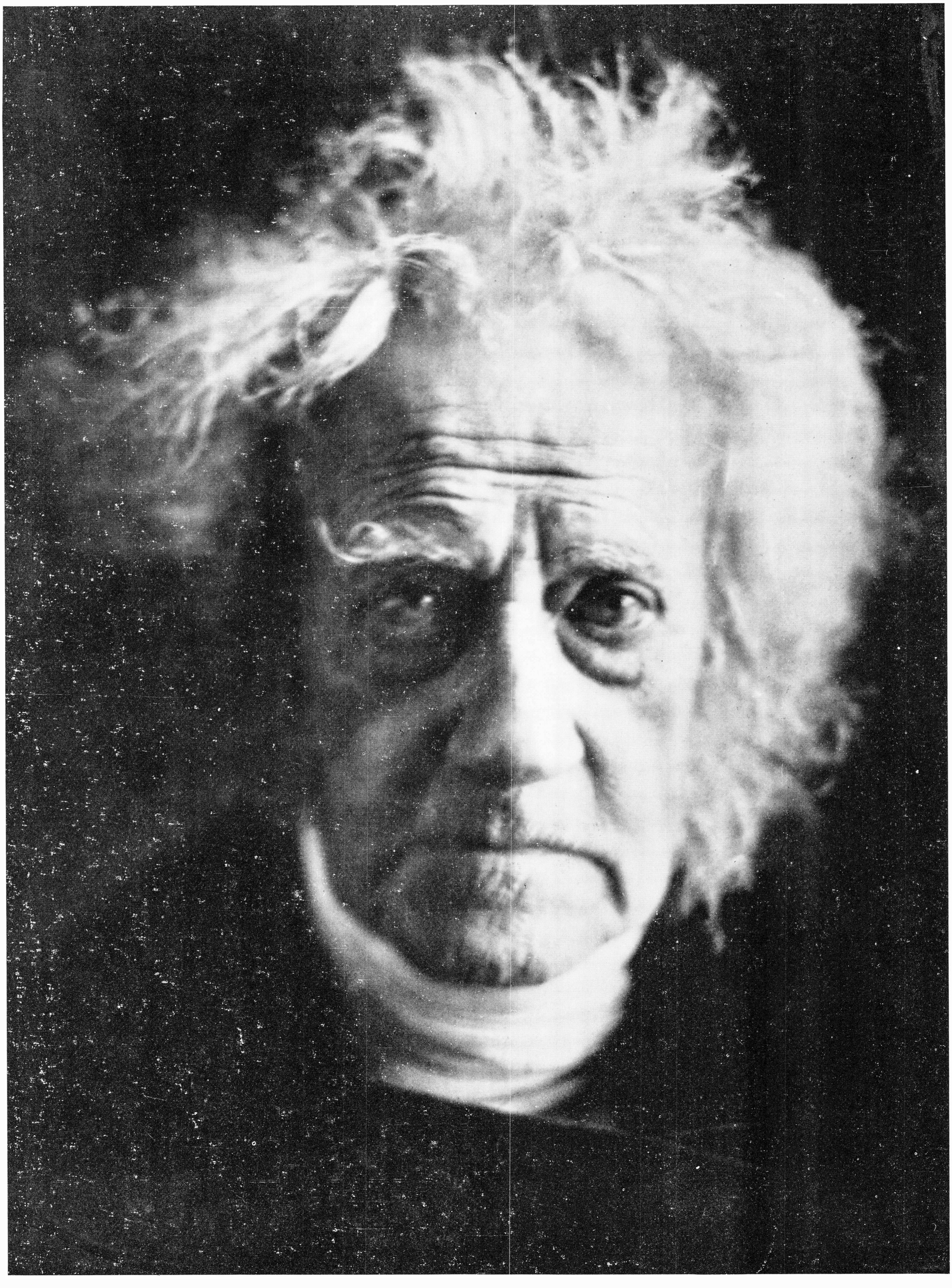
38 REV. J. B. READE, F.R.S., photograph by MAULL & POLYBLANK, *c.* 1856

39 The earliest extant photograph on glass, taken in September 1839 by SIR J. F. W. HERSCHEL. It shows the scaffolding erected for dismantling his father's telescope at Slough. Diameter $2\frac{1}{2}$ in. Original at Science Museum, London

40 HIPPOLYTE BAYARD, self-portrait, *c.* 1855. Société Française de Photographie, Paris

41 HIPPOLYTE BAYARD. Windmills at Montmartre. Direct positive on paper, 1839. Société Française de Photographie, Paris


BAL



42 SIR J. F. W. HERSCHEL, photograph by JULIA MARGARET CAMERON, 1867

Part III

THE EARLY YEARS OF PHOTOGRAPHY

10 The daguerreotype in France

In France many amateurs, artists and scientists immediately took up the new invention, and within a short time daguerreotypes reached a high state of perfection so far as static subjects were concerned. The only means of publication was, of course, to copy daguerreotypes as lithographs or engravings, but at least the public could be guaranteed truthful representations of architecture, sculpture, and landscapes–three branches in which the daguerreotype gave perfect results from the beginning. Daguerreotypes came as a great revelation after the romantic copperplate engravings published during the previous decades, when there was a craze for embellishing, exaggerating heights, and widening streets and squares, so that it would have been difficult for a visitor to recognize the view from pictures he had seen of it. Indeed, frequently the artist had not been there, but copied with 'improvements' from an earlier source.

The most enterprising of the early publishers of photographic views was N. P. LEREBOURS, a leading Paris optical instrument maker, who equipped a number of artists and writers with daguerreotype outfits of his own manufacture (similar to Giroux's) and commissioned them to take views in France, Italy, Spain, Greece, Egypt, Nubia, Palestine and Syria. Lerebours also received views from individual daguerreotypists in London, Bremen, Stockholm, Moscow, Geneva, Algeria, and of the Niagara Falls. The historical painter HORACE VERNET left Paris for Egypt on 19 October 1839 in order to daguerreotype scenes for his planned painting of the Battle of Nezib, and at the same time to take views for Lerebours, who supplied him with the apparatus and a darkroom-tent. Vernet, who was accompanied by Frédéric Goupil Fesquet, wrote from Alexandria on 6 November: 'We keep daguerreotyping away like lions, and from Cairo hope to send home an interesting batch–for here there is little to sketch. Tomorrow we are to make experiments with the instrument before the Pasha, who earnestly desires to appreciate for himself the results of a discovery known to him as yet only by description.'[1] Goupil Fesquet reported an exposure of two minutes in Alexandria on 7 November, whereas the Pyramids required fifteen to twenty minutes on 20 November.

By 15 December Lerebours had for sale at his shop in the Place du Pont-Neuf the first daguerreotypes taken to his order in Italy and Corsica. The year 1840 saw the publication of the first engraved plates of *Excursions Daguerriennes,* and during the next two years Lerebours published his two-volume work which contained fewer than one-tenth of the 1,200 daguerreotypes taken, copied as copperplate engravings and enlivened in many cases by the addition of figures. The first book claiming to be illustrated with lithographs based on the new art, *Paris et ses environs réproduits par le daguerréotype*, had appeared in 1840.

THÉOPHILE GAUTIER took a daguerreotype outfit with him when in 1840 he set out with his friend Eugène Piot on a trip to Spain. But judging from his book *Voyage en Espagne*, frequent rain made it impossible to take many pictures, though he does mention obtaining a good view of Burgos cathedral.

Some of the finest architectural and landscape views of the early period were taken by a French amateur JOSEPH-PHILIBERT GIRAULT DE PRANGEY, whose work remained entirely unknown until 1952. De Prangey was an expert on Islamic architecture. Engravings of his sketches made in 1832-3 of the Alhambra in Granada, in Dibujo and other places in southern Spain are exhibited in the Casa de los Tiros, Granada. In 1842 de Prangey undertook a long and arduous journey through Italy, Greece, Egypt, Syria and Palestine, arriving home two years later with about a thousand fine daguerreotypes. Some of the close-ups–as far as we know the first ever taken–formed the basis of the illustrations in his book *Monuments arabes d'Égypte, de Syrie et d'Asie Mineure*, Paris, 1846.

Pls 44, 45

Some unusual daguerreotypes were taken by a Frenchman named Tiffereau in Mexico in 1842–47. They included documentary pictures such as a Colima family preparing a meal outside their hut, and the extraction of silver ore.[2]

Despite Arago's opinion that 'one is little disposed to admit that the instrument will ever serve to make portraits',[3] there was a universal desire for portraits and attempts began almost immediately. One of the first was taken by SUSSE in September, but owing to the long exposure in direct sunshine 'the sitter had contracted features and a grimace expressing suffering'.[4] In spite of the poor results, Lerebours and Susse's edition of Daguerre's Manual published in November 1839 contains probably the earliest instructions on portraiture.

> To make a portrait, it is necessary to have recourse to a bright light; and this precaution is all the more necessary when the subject's complexion is high-coloured, for red is, so to speak, the equivalent of black.[5] One can only succeed well by exposing the person to the sun in the open air, with reflections from white draperies.
>
> If, as indicated by M. Arago [on Daguerre's advice], one places a large square of blue glass in front of the sitter, this will avoid fatigue which would inevitably cause blinking, and as the blue rays act in the most energetic manner, the operation will not be any slower.

The exact date of Susse's earliest portrait is not known but it may have been taken as early as September. From Théodore Maurisset's cartoon it could be inferred that Susse Frères took non-inverted portraits professionally by December (the date of the cartoon) in thirteen minutes without direct sunshine, but they must have been extremely poor as no-one can keep his eyes open for so long–even if head and body are supported. As we have been unable to trace any written evidence concerning a public portrait studio of Susse, we feel justified in not accepting the doubtful reference of a comic cartoon as fact.

The first portrait in Europe which can be documented was taken by DR ALFRED DONNÉ, head of the Charité Clinic and a well-known microscopist, and shown by him at the Académie des Sciences on 14 October 1839.[6] According to a German newspaper[7] Donné's portrait of a lady left much to be desired, for she had to keep her eyes shut on account of the bright sunshine, which made her look asleep or blind. Her face was powdered white, to act more quickly on the plate than flesh tones.

FRANÇOIS GOURAUD, Daguerre's American agent, states in his instruction manual in April 1840[8] that about the same time as Susse, ABEL RENDU, a civil servant at the Ministry of Public Instruction, succeeded in taking portraits in which the sitter's eyes appeared open, in 1 min. to 2 min. 27 sec., by using the Wollaston meniscus lens, which greatly shortened the exposure compared with Chevalier's and Lerebours's lenses–no doubt because it was used without a stop. This, however, rendered only the centre of the picture sharp. The size of Rendu's portraits is not stated, but they were presumably very small. Following Rendu's instructions Gouraud too took portraits, one of which he considered very good.

During 1840 it was still necessary to pose for several minutes motionless in sunshine, and the ferocious expression of the few intrepid people who submitted themselves to such experiments bore witness to their resolution and ordeal. The Paris optical instrument maker J. F. Soleil stated in April 1840[9] that he had not yet seen a really satisfactory portrait with the eyes open.

Since it proved impossible to take acceptable portraits with whole-plate apparatus on account of the long exposure necessary, Lerebours and Buron introduced quarter-plate cameras designed specially for portraiture and fitted with single or double achromatic plano-convex lenses of very short focus. With Lerebours's apparatus introduced in May 1840 at a price of only 75 francs, portraits could be taken in two minutes. Early in July 1841 Buron had a quarter-plate camera on sale measuring only 15 cm. × 17 cm. × 30 cm. (6 in. × 6¾ in. × 11¾ in.), so designed that all the equipment fitted into the camera box, the total weight being only 3·8 kg. (approx. 8¼ lb.). Two lenses could be used with this camera: one of 20 cm. focal length for landscapes, and one of 8 cm. focal length for portraits on one-eighth plates. The sitter was posed quite close to the camera–about 29 in. to two yards–his head fixed in a headrest, a device used by portrait painters long before photography. Owing to the short focal length of the lens, the parts nearest the camera–nose and hands–were often distorted. The exposure was stated to be one minute in full sunshine, or 2–3 minutes if the sky was covered with white clouds.

An undated half-length portrait of a man measuring about 1 in. × 2 in., is exhibited at the Conservatoire des Arts et Métiers, Paris. It may well be one of the earliest successful daguerreotype portraits taken in France, though the museum authorities do not draw attention to this fact.

It was not until 7 June 1841 that the acceleration method of Antoine Claudet (see page 138) became known in Paris and daguerreotype portraiture could begin in earnest. As neither Goddard's nor Kratochwila's acceleration methods seem to have been known in Paris, Claudet's chemical acceleration was considered the most important improvement in the daguerreotype since HIPPOLYTE FIZEAU's communication to the Academy on 10 August 1840 of his method of toning the image, after fixing, with chloride of gold, which increased the contrast of the image, protected it from abrasion, and tended to preserve the silver from oxidation.

Lerebours was probably the first person in France to open a public studio, taking about 1,500 portraits in 1841;[10] he was also one of the first to take 'Académies'–nude studies for artists and tourists.

Many people, used to miniatures, were at first disappointed by the unflattering photographic portraits.

> The most terrible enemy which the daguerreotype has to combat is, without contradiction, human vanity. When a portrait is painted, the flattering hand of the artist knows how to soften the irregular features of the face, to make graceful a

> stiff pose, and to give an effect of grace and dignity to the whole. Therein lies the talent of the portrait painter; one expects a likeness, but above all one wants to look beautiful–two demands which are often incompatible.
>
> It is not thus with the photographic artist: unable to correct the imperfections of nature, his portraits unfortunately often have the fault of portraying the sitter too truthfully; they are in a way *permanent mirrors* where vanity does not always find what it wants.[11]

Peu flatteur par principe,
Aimant la vérité,
Le Daguerréotype
Enlaidit la beauté.

In the early days of daguerreotype portraiture Queen Victoria asked the fashionable miniature painter Alfred Chalon whether he were not afraid that photography would ruin his profession. 'Ah, non, Madame,' he replied in a mixture of French and English, 'photographie can't flattère.'[12]

Prominent among the daguerreotype portraitists in Paris were the brothers LOUIS and AUGUSTE BISSON who, like Lerebours, opened a studio some time in 1841. In March 1842 they were awarded a medal by the Société d'Encouragement pour l'Industrie Nationale for a daguerreotype said to measure 'nearly one metre'–which could only have been of architecture or sculpture. About 1848 the Bissons were established by a financial backer in an elegant studio in the fashionable district of the Madeleine. This became a meeting place for well-known authors and artists such as Gauthier, Baudelaire, Balzac, Delacroix, Cormenin, and the art critic Jules Janin. About this time the Bisson brothers daguerreotyped all the members of the Chamber of Deputies and the Senate. To give these portraits wider publicity they were published as lithographs.

With still smaller and therefore faster cameras than those of Lerebours ($\frac{1}{6}$ or $\frac{1}{8}$ plate), and accelerating with bromine vapour, MARC ANTOINE GAUDIN was able to take some instantaneous street views in $\frac{1}{10}$ second showing people and traffic, provided they were not moving too rapidly. He showed a distant view of the Pont-Neuf with traffic to the Académie des Sciences in October 1841. A black velvet flap thrown over the lens acted as shutter.[13] Gaudin seems to have been the earliest to attempt portraits of little children, in 1843, and realizing that this demanded a psychological approach as well as an instantaneous process, he invented the stock phrase used by photographers of children all over the world to this day: 'Now look in the box and watch the dicky-bird!'[14]

To what extent exposures varied with the focal length of the lens and the size of camera used is clearly indicated in the following exposure table.[15]

	$\frac{1}{6}$ plate	$\frac{1}{4}$ plate	$\frac{1}{2}$ plate	whole plate
Sky veiled by slight white clouds	*sec*	*sec*	*sec*	*sec*
Apparatus turned to north	2–4	10–15	15–20	20–50
Apparatus turned to south	1–2	5–10	10–15	15–30
On an open terrace	1–2	5–12	10–20	20–40
With the object illuminated by the sun	*a fraction of a second*	1–4	3–6	6–10

The measurements of the plate sizes were:

	inches	*centimetres*
whole	6½ × 8½	16·5 × 21·5
half	4¼ × 6½	10·5 × 16·5
quarter	3¼ × 4¼	8·3 × 10·5
one-sixth	2¾ × 3¼	7·0 × 8·3
one-eighth	2⅛ × 3¼	5·3 × 8·3
one-sixteenth	1⅝ × 2⅛	4·0 × 5·3

The first big display of daguerreotypes anywhere formed part of the Exposition des Produits de l'Industrie Française held at the Palais de l'Industrie in 1844. Nearly one thousand daguerreotypes by the Bissons, Claudet, Derussy, Plumier, Sabatier-Blot and others were shown.

By 1847 photography had become such a widespread hobby and profession that 2,000 cameras and over half a million plates were sold in Paris alone.[16] That year constituted the zenith of the popularity of the daguerreotype in France. Leading professionals such as Richebourg, Derussy, and Victor Plumier in Paris, and I. Thierry and Vaillat in Lyons, took up to 3,000 portraits a year at 10 to 20 francs according to size, and style of frame.

Some beautiful panoramic views of Paris measuring 4¾ in. × 15 in. were taken by FRIEDRICH VON MARTENS, a German residing in Paris, with a camera of his own invention (1845). The lens was moved horizontally through an angle of more than 150° and the picture taken on a curved plate. Pl 46

Noteworthy, too, are the daguerreotypes of HIPPOLYTE MACAIRE of Le Havre taken in 1851. They showed a trotting horse, a moving carriage, a walking man, and seascapes with waves and steamships with smoke coming out of the funnel. For these novel subjects, taken in a fraction of a second, Macaire could command as much as 100 francs each. Some of his sea views were bought by the marine painter Eugène Isabey.[17]

From 1847 onward, paper photography won increasing favour for landscapes and architectural subjects, and two years later Baron Gros, diplomat and amateur photographer, forecast: 'Is it not easy to foresee that the daguerreotype has almost run its course, and that its rival on paper is destined by its indisputable advantages to carry the day against it?[18] Yet, as it turned out, not even the waxed-paper process was able to hold its own for long after the introduction of Frederick Scott Archer's wet collodion process. Published shortly before Daguerre's death in 1851, it superseded both the daguerreotype and the paper process within a few years.

At the Great Exhibition, London, in 1851 it was, strange to say, not the French but Americans who won the highest praise for daguerreotypes, though Antoine Claudet, a French photographer who had established himself in London, received the Council Medal, the highest award. The French were at that time regarded as leading in photography on paper.

11 *The daguerreotype in America*

The earliest account of daguerreotype pictures published in America was contained in a letter from the inventor and portrait painter SAMUEL F. B. MORSE to the New York *Observer*. Morse was in Paris in order to patent his electro-magnetic telegraph, and took the opportunity to call on Daguerre and demonstrate it to him. Daguerre in turn showed Morse his invention and he was greatly impressed: 'The exquisite minuteness of the delineation cannot be conceived. No painting or engraving ever approached it.'[1] Morse had himself many years earlier tried to fix the image of the camera obscura on silver nitrate paper, 'but finding that light produced dark, and dark light, I . . . gave up the attempt.'

Soon after his return home Morse, who was President of the National Academy of Design, New York, on 20 May informed Daguerre of his election as an Honorary Member of the Academy. This was the first honour Daguerre received from abroad.

The first successful daguerreotype in the New World was taken on 16 September by D. W. SEAGER, an English resident in New York.[2] Whether Seager had received by a fast French steamer Daguerre's instruction manual, published on or about 20 August, or the *Journal des Débats* of 20 August containing a full report by Dr Alfred Donné of the historic meeting at the Institut de France, is not known. His view, 'the size of a miniature painting', of St Paul's Church and surrounding houses, taken with an exposure of 8–10 minutes, aroused much interest when exhibited at Dr James R. Chilton's drug-store, 263 Broadway, and Seager gave a series of public lectures at the Stuyvesant Institute, starting on 5 October.

Seager not only introduced the daguerreotype into the United States, but also compiled the earliest exposure-table in the world, according to state of weather and time of the day. It was printed in the first American brochure on photography[3] on sale at Dr Chilton's shop in March 1840. This 16-page booklet consisted of a reprint of Daguerre's practical instructions as translated by J. S. Memes from Daguerre's first edition, various French improvements abstracted from *The Athenaeum*, London, 30 November 1839, together with Chilton's observations.

Four days after Seager's first daguerreotype, the steamship *British Queen* docked in New York, bringing with it London newspapers such as the *Globe* of 23 August and the *Literary Gazette* of 24 August containing reports of Arago's speech of 19 August, which enabled people to begin experimenting with the daguerreotype. Samuel Morse–at that period professor of the literature of the arts of design at the University of the City of New York–immediately had apparatus made by George W. Prosch, the constructor of his telegraph instruments, and at the end of September took a view of the Unitarian church from his third-floor room at the University, with an exposure of about 15 minutes. As a portrait painter Morse was naturally most interested in this aspect, and during October he posed his daughter and a friend on the roof of the University in full sunshine with their eyes closed–for the exposure lasted 10–20 minutes. The woodcut published many years later by Root[4] is misleading, for contrary to Morse's own statement, the girls are shown with open eyes. Dissatisfied, Morse wrote to Daguerre on 19 November that he had been experimenting 'with indifferent success, mostly, I believe, for want of a proper lens. I hoped to be able to send you by this opportunity a result, but I have not one which I dare send you.'

Morse's colleague DR JOHN WILLIAM DRAPER, an Englishman by birth and professor of chemistry at the University, after reading the *Literary Gazette* constructed a simple camera from a cigar-box fitted with an ordinary biconvex spectacle-type lens of 4 in. diameter and 14 in. focus. 'Within a day or two after the daguerreotype was made known here by the above Gazette I had accomplished the object.' Like Morse, his first subject was the conveniently situated Unitarian church.

Realizing that the exposure must be drastically reduced before satisfactory portraits could be taken, Draper fitted his camera with a spectacle lens of larger diameter (5 in.) and shorter focal length (7 in.).[5] Having experimented for several years on the chemical effects of light on sensitive paper (photometry), Draper was aware of the difference between the visual and the chemical focus of non-achromatic lenses. In order to obtain a sharp image, after focusing visually on the ground-glass in the usual way he 'pushed the back of the camera to the violet focus'. The chemically most active rays–blue and violet–are shorter and meet in front of the visually most effective red and yellow rays when passed through a lens. The difference between the visual and chemical focus is about 2 per cent. of the focal length of the lens.

Draper made his first attempts at portraiture indoors. To begin with he powdered the sitter's face with flour, but soon abandoned this procedure because it increased the contrast between face and dress. At length during December he succeeded in producing portraits by the daguerreotype.

Following a detailed description of the daguerreotype process published by Professor J. F. Frazer in the *Journal of the Franklin Institute*, Philadelphia, October 1839–or possibly one that had already appeared in the *United States Gazette* published in Philadelphia on 25 September–JOSEPH SAXTON, an employee of the United States Mint, took the first daguerreotype of Philadelphia on 16 October. The picture, measuring $1\frac{1}{8}$ in. × $1\frac{1}{2}$ in. and showing the old arsenal and the cupola of the Philadelphia Central High School, was taken from a window of the Mint. It is the earliest surviving American daguerreotype and is preserved at the Historical Society of Pennsylvania. Though far from perfect, even allowing for blemishes and dust which may have accumulated on it later, this first attempt was nevertheless 'sufficiently successful to demonstrate the beauty of the art when perfected.'[6]

Meanwhile at the beginning of October ALEXANDER S. WOLCOTT, a New York manufacturer of dental supplies, jointly with his partner John Johnson started experimenting in the hope of taking portraits. On 7 October he succeeded in taking a tiny profile portrait of Johnson. It was smaller than a signet-ring, measuring only $\frac{3}{8}$ in. (9 mm.).

Though Daguerre did not follow up Morse's suggestion to introduce his process into the United States personally and to have an exhibition of his pictures, the idea of establishing an overseas agency for the sale of apparatus struck him and Giroux, and on 23 November 1839 their agent FRANÇOIS GOURAUD arrived in New York. He immediately sent out invitations to prominent New Yorkers to the private view of an exhibition at the Hotel François on Broadway on 4 December. The thirty daguerreotypes by Daguerre and his pupils were of subjects similar to those shown in Paris, and aroused equal interest and enthusiasm. The four-page leaflet listing the pictures constitutes the first photographic exhibition catalogue.

> We have seen the views taken in Paris by the 'Daguerreotype' and have no hesitation in avowing that they are the most remarkable objects of curiosity and admiration, in the arts, that we ever beheld. Their exquisite perfection almost transcends the bounds of sober belief. Let us endeavour to convey to the reader an impression of their character. Let him suppose himself standing in the middle of Broadway, with a looking glass held perpendicularly in his hand, in which is reflected the street, with all that therein is, for two or three miles, taking in the haziest distances. Then let him take the glass into the house, and find the impression of the entire view, in the softest light and shade, vividly retained upon its surface. This is the Daguerreotype! . . . There is not an object even the most minute, embraced in that wide scope, which was not in the original; and it is impossible that one should have been omitted. Think of that![7]

It is clear from this eulogy that the French daguerreotypes were infinitely superior to anything that had so far been seen in the States.

During the next fortnight the exhibition was open to the public at a charge of one dollar, and Gouraud gave two demonstrations daily. On 20 December Gouraud moved his collection to the 'new granite building'–where Wolcott and Johnson were to open their Daguerrean Parlor three months later–reduced the price of admission by half, and took a number of pupils, among whom was Morse. This proves that Morse had not obtained very satisfactory results so far, but by February 1840 his pictures were so much improved technically that one of them was praised in the *Evening Post* as being equal to the best of those taken by Daguerre himself. When Gouraud tried to take the credit for Morse's success[8] the latter replied: 'All the instruction professed to be imparted by M. Gouraud, I have felt it necessary to forget.'[9] Moreover, Morse publicly accused Gouraud of degrading the name of Daguerre by selling toilet articles and patent medicines at his exhibition. In the midst of this dispute carried on in the press Gouraud moved to Boston, where he opened his exhibition on 6 March. Here, too, he took pupils, among them Edward Everett Hale, Pl 48 ALBERT SANDS SOUTHWORTH and JOSIAH JOHNSON HAWES: the latter two the following year jointly opened a portrait studio in Boston. They produced what many people consider the finest daguerreotypes in America. It was in Boston, at the end of March or beginning of April 1840, that Gouraud published *A Description of the Daguerreotype Process; or a Summary of M. Gouraud's Public Lectures according to the Principle of M. Daguerre*.[10] In our opinion this sixteen-page brochure contains clearer instructions on the daguerreotype manipulation than Daguerre's own. It ends with a lucid description of 'the manner of taking portraits', which had already been separately published in the *Boston Daily Advertiser* of 26 March. After recommending a room of south-east aspect with a large window from floor to ceiling, with floor, ceiling and walls plastered white or covered with white sheets, Gouraud continues:

> The focus of the room must be covered with a tapestry of white cotton, with knotted or raised figures, which is designed to form the drapery. These are always agreeable to the eye, and should always be shewn in interior views. The chair on which the person sits must be of yellow wood. The person, if a man, must be dressed in a clear grey coat, pantaloons of a little deeper hue, a vest of a fancy

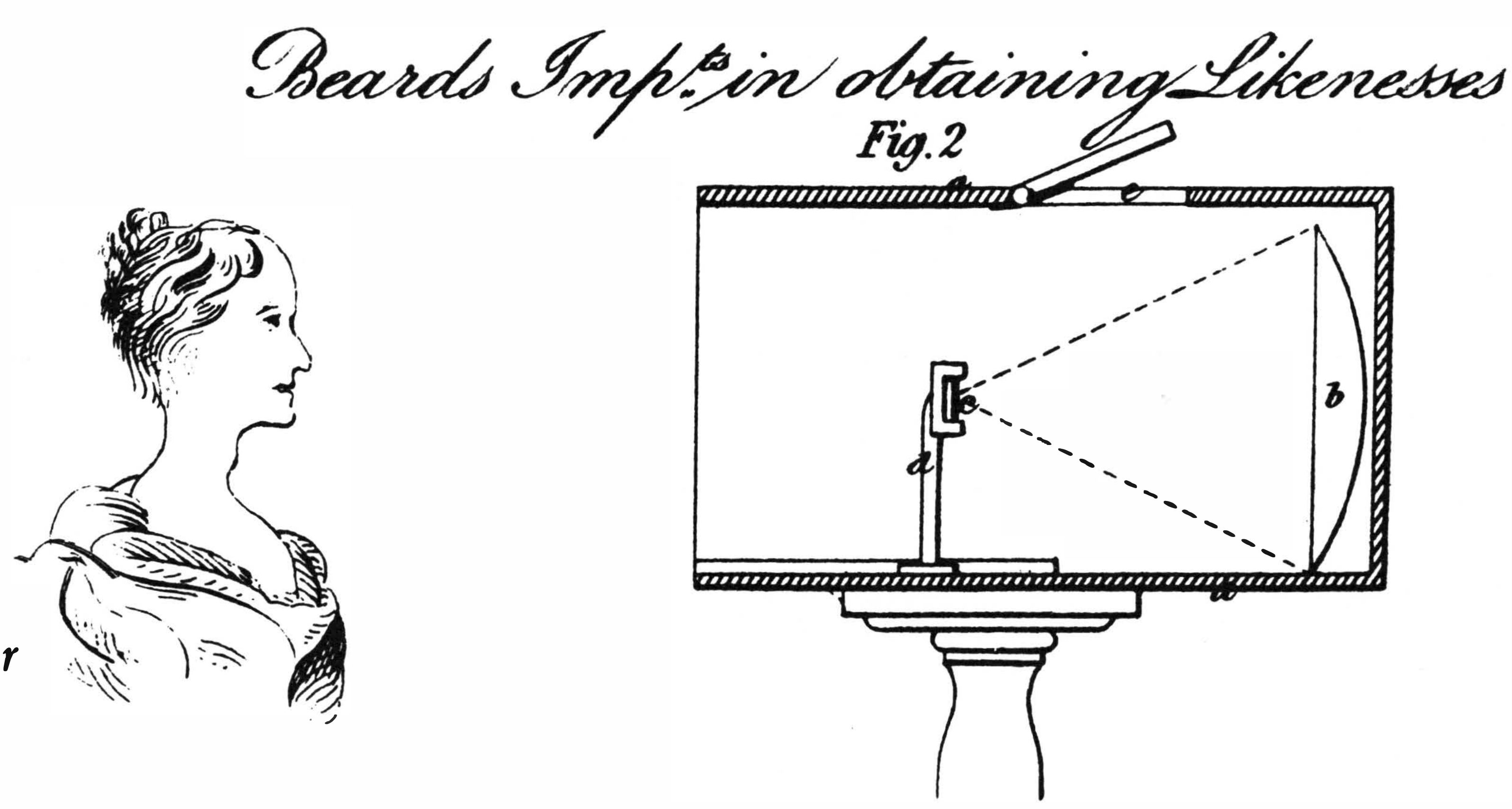


Fig 10 Wolcott's mirror camera, used in Beard's studio, 1840–3

> ground, yellow, orange, if possible, with figures of a colour to make a constrast, the whiteness of the shirt contrasting with a cravat of a grey ground, either a little less dark or more deep than the coat. The toilet of a lady should be of the same shades, and in all cases black must be constantly avoided, as well as green and red. This arrangement, however, is pointed out as the best means of obtaining the best effect; for, as in a portrait, the face is what is most cared for, the costume can be studied more or less at will, but the portrait, with other arrangements, will not be so agreeable to the eye. By means of mirrors properly disposed at the window or in the room, you will concentrate the strongest possible light on the person, and will considerably augment that of the chamber, which has already been made as clear as possible. If the sun should be too brilliant, and the *patient* is not able comfortably to bear the reflection of it, use may be made of the blue glass, recommended by M. Daguerre.
>
> Having covered your plate well with the coating of iodine, you will fix the sitter. His head should be placed on a semi-circle of iron, fitted to the back of the chair. His arms may be arranged at pleasure. He should fix his eyes on some well defined object in any direction which he may prefer. The focus of the camera obscura must be regulated and provided with a good Meniscus. Now, if every thing has been arranged as it should be, your portrait will often be made, even in less than *twenty seconds*, and in the most satisfactory manner.
>
> This is, *at present*, the most approved method of making a miniature by the Daguerreotype. Others may perhaps pretend to improve or invent, after my explanations have been made, because while employing the same means, they will change their places, or call them by other names. But until other methods shall have better success, it is certainly right that those who attach any importance to a futile celebrity should render to Cæsar the things which are Cæsar's, and it is right that the method of M. Abel Rendu, *rendered* public by me in this country, should be attributed entirely to him.

It will be noticed that Gouraud gives full credit for the method to Abel Rendu (see page 117) who had instructed him in this novel branch just before he left Paris in late October, but it is a mystery how he should have achieved an exposure of only 20 seconds using the same equipment as Rendu who needed a minimum of one minute. We consider this claim a gross exaggeration.

During the winter of 1839–40 Wolcott, Morse and Draper continued experimenting with portraiture. The former, finding it impossible to arrive at reasonably short exposures with an ordinary camera, had a novel type of apparatus designed for him by HENRY FITZ, a maker of telescopes and lenses. In this a concave mirror was used to reflect the rays on to the sensitized plate, instead of passing them through a lens. The suggestion to substitute a mirror for the lens had been made as early as April 1839 by DR ANDREW FYFE, President of the College of Surgeons, Edinburgh, in a communication to the Society of Arts, Edinburgh: 'The concentration of the rays by a metallic mirror so as to get quit of the interference of the lens would no doubt be a great improvement in the camera obscura, provided it could be accomplished.'[11] It is, of course, quite possible that Fitz took the idea from the well-known Gregorian telescope in which the objects are reflected from a concave mirror on to another small concave mirror, which in his camera design was replaced by the daguerreotype plate. Fig 10 The apparatus was patented by Wolcott on 8 May 1840, constituting the first U.S. patent relating to photography. The light-rays passing through the large circular opening in the front of the wooden box 15 in. × 8½ in. × 8 in. were reflected by a concave metal mirror at the back of the camera on to the sensitized plate, which was held in a small frame somewhat behind and in the centre of the open front, facing the mirror. The brass pedestal carrying the frame and plate could be moved backwards and forwards for focusing, the base of the pillar sliding in a slot in the bottom of the box. When the operator had obtained the exact focus on an unsensitized plate by looking through an opening in the top of the camera, the plate was removed and a sensitized one put in its place. On account of the open front of the camera a certain amount of stray light was unavoidable. The concave mirror, of 7 in. diameter and 12 in. focal length, had the great advantage of reflecting many times more light on to the plate than if the light had passed through a lens. Another advantage was that the image was not reversed; but, on the other hand, the mirror limited the size of the portrait to 2 sq. in., and the image was slightly soft.

By the beginning of March 1840 Wolcott was able to open the world's first photographic portrait studio:

> Sun Drawn Miniatures. Mr A. S. Wolcott, of No. 52 First Street, has introduced an improvement in the daguerreotype, by which he is enabled to execute miniatures, with an accuracy as perfect as nature itself, in the short space of from three to five minutes. We have seen one, taken on Monday, when the state of the atmosphere was far from favourable, the fidelity of which is truly astonishing. The miniatures are taken on silver plate, and enclosed in bronze in cases, for the low price of three dollars for single ones. They really deserve the attention of the scientific, and are a valuable acquisition to art, and to society in every respect.[12]

Nine days later it was reported that Wolcott had moved to rooms in the new granite building at the corner of Broadway and Chambers Street. Here Wolcott and Johnson installed an ingenious lighting system. Two adjustable mirrors fixed outside the window reflected the sunlight on to the sitter, after passing through a trough of plate-glass filled with a solution of sulphate of copper, the blue colour of which had the same function as Daguerre's suggested blue glass, with the additional advantage of heat absorption. Behind the sitter, who was supported by a headrest, a plain screen served as background. Quite possibly Henry Fitz was employed as operator before opening his own studio in Baltimore. The Smithsonian Institution possesses several very early daguerreotypes by Fitz, one of them said to be a self-portrait with the eyes closed. Whilst this was probably taken before the end of 1839, the successful ones of his sister at the Institution were more likely taken with the mirror camera in February or March 1840.

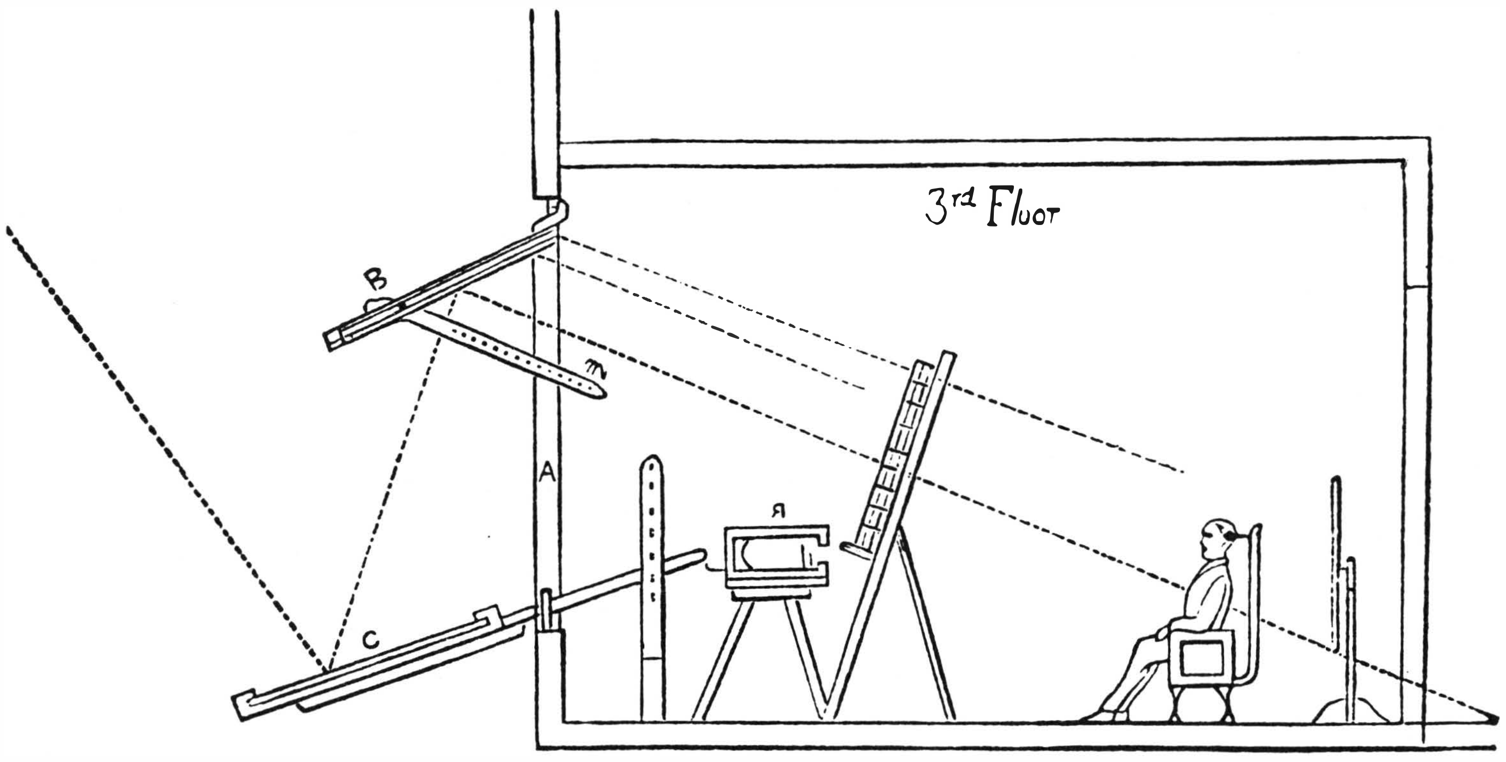


Fig 11 Wolcott's studio lighting arrangement, adopted by Beard, 1840

Wolcott's mirror camera and lighting arrangements were also used in the first Fig 11 portrait studio in Europe, which was opened by Beard in London in March 1841 (see page 135). A portrait studio *could* have been opened just as well using Voigtländer's camera and Kratochwila's accelerating process if these Viennese improvements had been known in London at the time.

Morse, seeing that the portrait business at last showed prospects of success, proposed to Wolcott to join him in the working of the invention.[13] Receiving a negative reply, he suggested a joint venture to Professor Draper, and this seemed an ideal partnership of artist and scientist. A glass-roofed studio was hastily constructed on the roof of the university, where from about April 1840 on they took portraits at a charge of four dollars (then £1) per picture.[14] Using similar lighting arrangements to Wolcott's Morse and Draper found that they could take portraits in times varying from 40 seconds to 2 minutes, according to the intensity of the light. If posed in direct sunshine in the open air the time was reduced to 20–90 seconds, but they preferred indoor portraits, which gave a less strained expression. Their camera was locally made and had a combination lens consisting of two non-achromatic biconvex lenses of 4 in. diameter and a combined focal length of 8 in., mounted in a conical tube which reduced the effective lens opening to $3\frac{1}{2}$ in.

Morse being a well-known portrait painter, the partners had during the summer vacation all the business they could possibly attend to. Many leading New Yorkers sat for their portraits, among them Mr Frelinghuysen, the Vice-Presidential candidate. As Morse and Draper could only operate on sunny days, they used to teach the manipulation to would-be photographers in dull weather. Indeed, there were even more people wishing to be trained than wanting their portraits taken.

In April or May Draper sent to the *London & Edinburgh Philosophical Magazine* a lengthy communication on portraiture[15] based on his experiences and arrangements in the New York studio. Though not published until September, it was still the first detailed instruction to appear in Europe, where it was not yet possible to take good portraits.

None of Wolcott's portraits seem to have survived so it is impossible to draw any comparison between them and the portrait of Miss Dorothy Catherine Draper, Pl 49 sister of Dr Draper, whom he photographed in June or July 1840 'in 65 seconds when the sky was covered with thin white clouds'. It measured $2\frac{3}{4}$ in. × $3\frac{1}{2}$ in. and is the earliest good photographic portrait in the world to survive until modern times.[16] On 28 July Draper sent it to Sir John Herschel, who, in thanking him for it, declared it to be 'by far the most satisfactory *portrait* I have yet seen',[17] though he was disappointed that the bright spot in each eye failed to reveal, under the microscope, a picture of the landscape reflected in it!

In the autumn Draper retired from photographic portraiture and devoted his time to scientific pursuits. On 27 July 1842 he took the first solar spectrum photograph, and this daguerreotype, which he also sent to Sir John Herschel, formed the basis of the latter's memoir 'On the action of the rays of the solar spectrum on the daguerreotype plate'.[18]

Left on his own, Morse moved to the new premises of the New York *Observer*. Here he was 'tied hand and foot during the day endeavouring to realize something from daguerreotype portraits' for over a year. 'My ultimate aim is the application of the daguerreotype to accumulate for my studio models for my canvas', he wrote to a cousin in February 1841. He continued to augment his income by giving instruction at 25 to 40 dollars a course. Among his pupils were men who afterwards became leading daguerreotypists in the States–Edward Anthony, Mathew B. Brady, and Albert S. Southworth.

Among the most successful daguerreotypists of the early period was JOHN PLUMBE, a Welshman by birth; he opened the Plumbe National Daguerrian [*sic*] Gallery in Boston some time in 1840 and by September 1845 had a chain of fourteen studios 'constituting the most extensive establishment of the kind in the world'[19] and stretching across the American continent from Boston to St Louis. This enterprising businessman, whom the New York *Herald* hailed as 'the American Daguerre', also employed lithographers to copy daguerreotype views and portraits, which he published as 'Plumbeotypes' at his Philadelphia branch. However, he had undertaken more than he could manage and in 1847 became bankrupt.

By 1841 most of the principal towns in the U.S.A. had a 'Daguerrean Parlor', or at least a visiting daguerreotypist. Most of them were uneducated people who had been attracted to the business by the quick returns offered, and having but scanty knowledge of the manipulation, their results were usually poor. John Quincy Adams, sixth President of the United States, recorded in 1843: 'Four daguerreotype likenesses of my head were taken, two of them jointly with the head of Mr Bacon–all hideous'; and 'We stopped at a daguerreotype office, where three attempts were made to take my likeness. I believe that none of them succeeded.'[20]

CYRUS MACAIRE, a Frenchman seeking his fortune in America in 1840–41, was one of the itinerant photographers in the Southern States. Owing to under-exposure his portraits often turned out black and were refused by the sitter. Undaunted, Macaire passed them off on the slaves, who recognized themselves without hesitation in the portraits of their masters. This business proved so good that in the end Macaire posed whites to furnish the portraits of Negroes![21]

JOHN LLOYD STEPHENS, a New York explorer, and FREDERICK CATHERWOOD, an English architect, in 1841 revisited the lost cities of Yucatan where they had been two years previously. The daguerreotypes which they took of ruined Mayan architecture, supplemented by Catherwood's camera lucida drawings, were published as engravings in *Incidents of Travel in Yucatan*, 1843.

Two Germans, WILLIAM LANGENHEIM and his brother FREDERICK, opened a daguerreotype studio at the Exchange in Philadelphia in 1841 or 1842. Among the many prominent Americans who sat to them were President Tyler, Henry Clay, and General Lewis Cass. A daguerreotype they made of people sitting drinking at a table in the Exchange restaurant hung for a time in the corridor of the building as an advertisement, until its 'demoralizing' effect raised a storm of protest.[22] Unfortunately this first advertising photograph does not seem to have survived. Today the reputation of the Langenheims as daguerreotypists rests chiefly on their panorama of the Niagara Falls made up from five separate views taken in July 1845. Sets of these daguerreotypes, mounted in specially designed frames, were presented to Queen Victoria, the Kings of Prussia, Saxony, and Württemberg, the Duke of Brunswick (the birthplace of the Langenheim brothers), and to Daguerre, who sent them letters of appreciation and presents. The Langenheims' own panorama was shown at the exhibition which Beaumont Newhall arranged at the Museum of Modern Art in 1937 to celebrate the centenary of Daguerre's first successful picture.

A huge panorama of Cincinnati was taken in September 1848 by **CHARLES FONTAYNE** and his partner **W. S. PORTER**. This 8 ft-long panorama is composed of eight 12 in. × 10 in. daguerreotypes of the Cincinnati waterfront taken from across the Ohio river in Newport and covering a stretch a little over two miles long.

Other prominent early American daguerreotypists include **CHARLES R. MEADE**, **M. M. LAWRENCE** and **JEREMIAH GURNEY**, all in New York. **EDWARD ANTHONY** in partnership with **J. M. EDWARDS** opened a portrait studio in Washington, D.C., in 1842 and photographed all the Members of Congress. **MARCUS A. ROOT** of Philadelphia was from 1842 to 1846 in partnership with **J. E. MAYALL**, later a leading photographer in London.

The most famous name in the history of American photography is that of **MATHEW B. BRADY** (see chapter 22), who has already been mentioned as a pupil of Morse in 1840–41. Before opening his Daguerrean Gallery in New York in 1844, Brady was in business as a manufacturer of daguerreotype cases. In 1850 he published twelve lithographs, copied from daguerreotypes, under the title 'Gallery of Illustrious Americans', but as the project did not prove a financial success the intended further series were dropped. The largest collection of Brady daguerreotypes, 311 in number, was acquired by the Library of Congress in 1954, but unfortunately most of them had already suffered considerable damage through neglect.

A novel business was established by **PLATT D. BABBITT** in 1853 at the Niagara Falls, where he was granted a monopoly of the American side. Babbitt set up a pavilion under which his camera stood in position all day; when a party of sightseers gathered on the edge of the cliff to admire the Falls he would take them unawares, and of course they were always glad to buy the picture as a souvenir. Babbitt was probably the first to specialize in this kind of tourist photography. Soon after he had obtained his concession, two men boating on the upper Niagara river got caught in a fast current, were sucked into the rapids, and their boat smashed on the rocks. One of them was swept over the Falls at once, but the other clung for eighteen hours to a log which was jammed between two rocks. All attempts at rescue failed, for the water rushed past at eighteen to twenty miles an hour, and eventually the doomed man, exhausted, was swept away. Babbitt took several daguerreotypes, which are in the nature of early news photographs, and presented one of them to John Werge, who wrote about the occurrence.[23] Pl 51

ROBERT H. VANCE of San Francisco is stated[24] to have taken in 1850 over 300 whole-plate daguerreotypes of California: scenery, views in San Francisco, Sacramento and Monterey, the gold mines and miners at work, Indians on the Pacific Coast, etc. This interesting collection was exhibited in New York in the autumn of 1851, when it was said that they were so arranged that 'a circuit of several miles of scenery can be seen at a glance'.

S. N. CARVALHO, a Baltimore artist and daguerreotypist, related in his book *Incidents of Travel and Adventure* (New York, 1859) his astonishing adventures as photographer to Col. John C. Frémont's expedition from Westport, Missouri, to Utah, 1853–54. In crossing the Rocky Mountains during the winter the party nearly perished, and was forced the abandon all heavy baggage including the daguerreotype equipment, except the pictures themselves, which had been taken under the greatest imaginable difficulties, some of them 'on the summits of the highest peaks of the Rocky Mountains with the thermometer at times from 20°–30° below zero, often standing to my waist in snow, buffing, coating and mercurializing plates in the open air.'[25]

Like so many of the early photographic documents of the frontier days, the Carvalho and Vance daguerreotypes are apparently no longer in existence. This also applies to those taken by E. Brown, who was officially attached to the U.S. Naval expedition under Commodore Perry which opened up Japan to the West in July 1853. The official report published in Washington four years later was illustrated with woodcuts and lithographs, including fourteen copied from Brown's daguerreotypes.

In 1853 the daguerreotype reached its most widespread popularity in the States. Shortly before, no fewer than 10,000 people were estimated to be earning their living as daguerreotypists, to which may be added at least another 5,000 in allied trades such as the manufacture of apparatus, chemicals, plates, and cases.[26] On the banks of the Hudson river a town grew up round a large factory making daguerreotype supplies, and was appropriately named Daguerreville. Three million daguerreotypes were estimated to be produced anually,[27] and there were about a hundred portrait studios in New York City alone. The fierce competition brought down the price of daguerreotypes to as little as two dollars (in those days ten shillings), complete in an ornamental leather case, and hand-coloured.[28] The daguerreotype remained popular in the U.S.A. until the early 1860s, longer than anywhere else. Moreover it was not in France, which had given birth to photography, but in the New World that the first photographic journal was published: *The Daguerreian Journal: devoted to the Daguerreian and Photogenic Arts*, the first number of which appeared in New York in November 1850.

At the Great Exhibition in London, 1851, American daguerreotypes were particularly praised, the Jury stating:

> Every observer must be struck with their beauty of execution, the broad and well-toned masses of light and shade, and the total absence of all glare which render them so superior to many works of this class. Were we to particularize the individual excellences of the pictures exhibited, we should far exceed the limits of space to which we are necessarily confined. Where all is good, it follows that the remarks must be restricted to peculiar excellence alone. It is but fair to our own photographists to observe that, much as America has produced and excellent as are her works, every effort has been seconded by all that climate and the purest of atmospheres could effect; and when we consider how important an element of the process is a clear atmosphere, we must be careful not to overrate the superiority of execution which America certainly manifests.

The highest award in the American section, the Council Medal, went to M. M. Lawrence of New York for a number of uncoloured portraits, two of them measuring 10½ in. × 12½ in. Mathew Brady, exhibiting forty-eight portraits, received only a Prize Medal, the next highest award, for, it was remarked, 'The artist having placed implicit reliance upon his knowledge of photographic science, has neglected to avail himself of the resources of art.' The only other award to an American was a Prize Medal to **JOHN A. WHIPPLE**, a portrait photographer of Boston, for a daguerreotype of the moon taken that year through the Harvard University telescope–a photograph which was described by the jury as marking a new era in astronomical photography.

The high praise accorded to American daguerreotypes at the Great Exhibition is partly due to their technical brilliance. They are particularly clear, owing to their highly polished surface, for the Americans used steam-machinery to drive cleaning and buffing wheels and their plates are therefore free from the buff-lines visible in most English and Continental daguerreotypes. Another reason for the great prominence of the Americans at the Crystal Palace is the fact that none of the leading German daguerreotypists such as Stelzner and Biow were represented. To avoid any erroneous impression we would add that two of the highest awards went to daguerreotypists active in London, namely A. Claudet (Council Medal) and E. Kilburn (Prize Medal), whilst J. E. Mayall, an American by birth but an Englishman by adoption, had to content himself with an Honourable Mention.

12 *The daguerreotype in Great Britain, 1839–c.1857*

In chapter 6 we made passing reference to the patenting of the daguerreotype in England. As early as 1 June 1839[1] Daguerre and Isidore Niépce engaged Miles Berry, an English patent agent and civil engineer, and on or about 15 July instructed him

> immediately to petition Her Majesty to grant Her Royal Letters Patent for the exclusive use of the same within these kingdoms, and in consequence thereof I did apply for such Letters Patent and Her Majesty's Solicitor General, *after hearing all parties who opposed the same* [authors' italics], was pleased on or about the second day of August to issue his report to the Crown in favour of the Patent being granted, and it consequently passed the Great Seal in the normal course, being sealed on the day above named [i.e. 14 August].[2]

This first English patent for photography entitled Miles Berry to 'make, use, exercise and vend, within England, Wales, and the town of Berwick-upon-Tweed, and in all Her Majesty's Colonies and Plantations abroad, an invention of A NEW OR IMPROVED METHOD OF OBTAINING THE SPONTANEOUS REPRODUCTION OF ALL THE IMAGES RECEIVED IN THE FOCUS OF THE CAMERA OBSCURA, being a communication from a foreigner residing abroad'.

Five days later, Arago flamboyantly announced: 'France has adopted this discovery and from the first moment has been proud that it can generously donate it to the entire world [*le monde entier*].' This was ostensibly the intention of the French Government when granting pensions to Daguerre and Niépce, for the Minister of the Interior, in laying the Bill relating to the discovery before the Chamber of Deputies on 15 June, supported his request for the pensions with this statement:

> Unfortunately for the authors of this beautiful discovery, it is impossible for them to bring their labour into the market and thus indemnify themselves for the sacrifices incurred by so many attempts so long fruitless. *Their invention does not admit of being secured by a patent* [authors' italics]. As soon as it becomes known, anyone can make use of it. . . . It thus follows that this process must belong to everybody [*à tout le monde*] or remain unknown. [And to ensure the safe passage of the Bill, Duchatel made its endorsement a matter of patriotism.] You will never suffer us to leave to foreign nations the glory of endowing the world of science and art with one of the most wonderful discoveries that honour our native land.

Gay-Lussac, the spokesman of a special commission charged with the examination of the Bill, asked the Chamber of Peers on 30 July, 'Why in the face of so many wise laws protective of rights such as this, does the Government propose to purchase the secret in order to *publish it to the world*?' and he answered his rhetorical question very sensibly: given to the public, the process would receive innumerable applications useful to mankind, but if it remained the secret of an individual, the invention would long remain stationary. Rendered public, it would be extended and improved by general emulation. The Bill was passed the same day.

Within a month of taking out the patent, Miles Berry was in the Court of Chancery, for he was regarded as trying to exploit an invention which had been given free to the world. When he revealed that he had acted on the inventor's instructions, the legality and morality of Daguerre's action was questioned, for the control of the invention in England by a patent appeared entirely inconsistent with the magnanimity of the French Government. Baffled by this inconsistency, the English naturally wondered, 'Is Daguerre legally entitled to the patent?' An English artist named John Pye requested a clarification of the matter and Daguerre answered on 7 October 1839, 'If you will take the trouble to read attentively the articles of the agreement between me and the French Government, you will see the process has been sold, not to the civilized world, but to the Government of France, for the benefit of my fellow countrymen.'[3] It was undeniable that Daguerre and Niépce sold the invention to the French Government, but, equally unmistakably, responsible officials had announced that the State had acquired the invention for the benefit of the whole world. So the English wondered again, 'When Arago and Duchatel said that the invention did not admit of being secured by a patent, did they mean only a French patent? or do Frenchmen really hyperbolically call France "the whole world"?' (as the English patentee claimed some years later).[4] One thing is certain now: Daguerre could only have taken out the patent *with* the knowledge of Arago and the French Government; it is quite inconceivable that he would have risked a public scandal in France at the moment of his greatest triumph; and for this reason we cannot but charge the French Government with hypocrisy.

Why was England alone singled out for patenting the daguerreotype? The opinion has been expressed that Daguerre wanted to protect himself against the possible rivalry of Talbot, but this argument would only be logical if he had applied for a patent before the end of January 1839 when Talbot announced his process, which made it plain that the two inventions were totally different. It is far more likely that, the invention of photography being a matter of *national* rivalry, the French Government agreed with Daguerre's contention that if the English wanted to photograph they would have to make use of the French process, thus openly acknowledging its superiority over the English invention. We shall probably never unveil this mystery. From the standpoint of economics, too, a patent was much more likely to be a paying proposition in England than in any other country, because England was then leading the world in commerce and industry, and inventions had a much better chance of commercial exploitation there than anywhere else.

Daguerre had long been maturing his plans for England. Barely three weeks after Arago's preliminary announcement of the invention he had an agent in London to receive subscriptions for the camera.[5] From the timing of the patent it will be noticed that he was most careful to observe the letter of his agreement with the French Government, which laid down under article 3, 'The description of the process is not to be given publicly until the draft of the law here discussed is accepted.' This was on 30 July, a fortnight before the patent was sealed. Shortly before, on 22 June 1839, he and his partner signed a contract with Alphonse Giroux, Mme Daguerre's relative, granting him the monopoly of manufacturing daguerreotype apparatus in France and elsewhere *with the exception of England*, yet assigning to him the first exhibition rights in that country.[6]

On 19 February 1840 the partners signed a contract with Elzéard Désiré Letault, whom they sent to England as their representative 'for the purpose of pursuing, dealing and concluding whatever is necessary for their interest'. Letault's specific mission was to sell the daguerreotype patent to the British Government, and the price Daguerre expected to obtain was about half what he claimed had been offered him before the French Government acquired the invention, for Letault's commission was to be 1,500 francs if the sale price should be less than 100,000 francs (£4,000). If that sum was reached, his remuneration was to be 2,000 francs, and he was to receive an interest in the entire half of that sum by which the 100,000 francs was exceeded.[7] Letault's expenses allowance was £1 a day, a generous sum considering the value of money at that period.

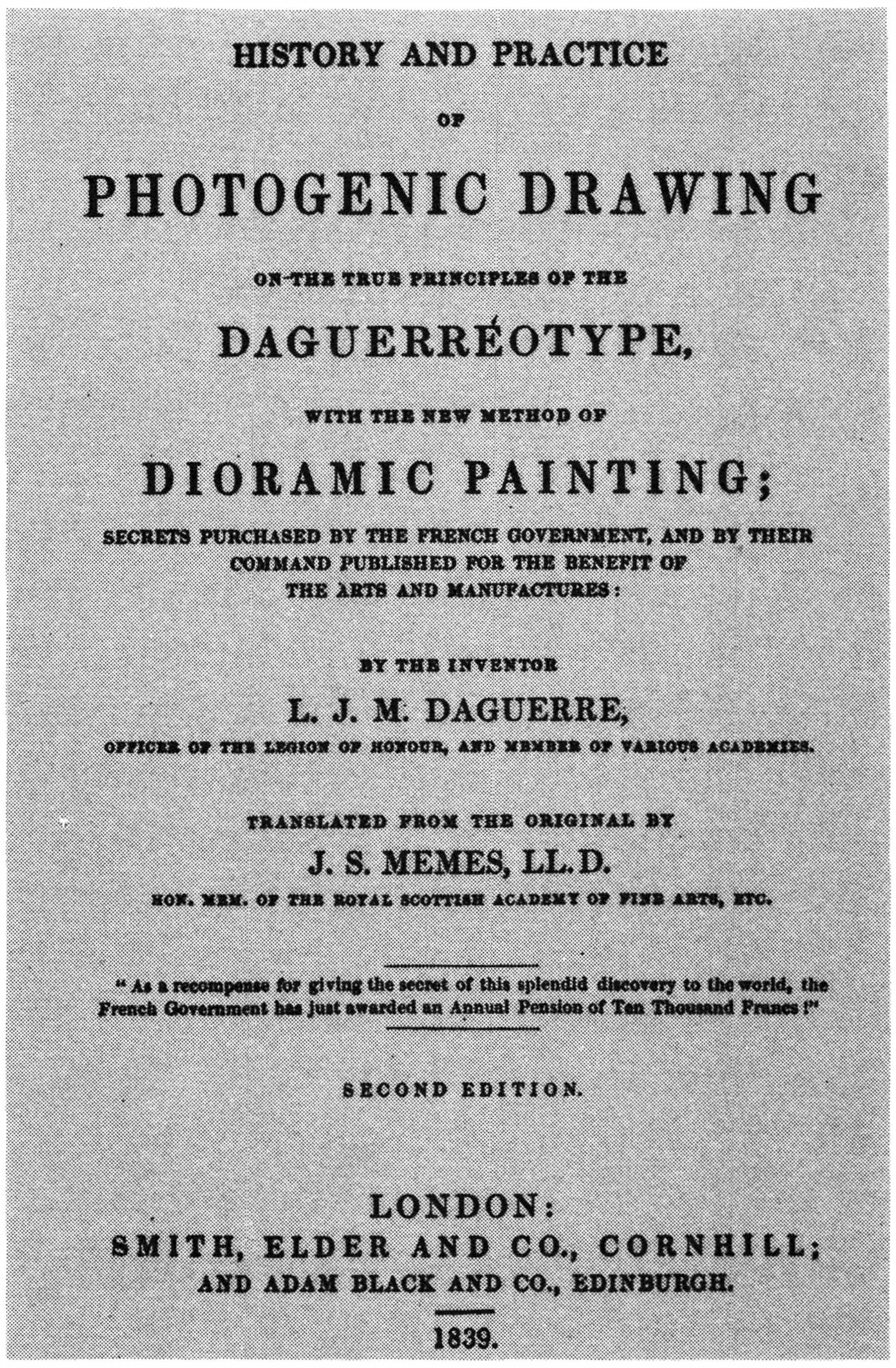
However, all these careful plans to exploit the daguerreotype in England brought Daguerre little profit. As the process was not yet fast enough for portraiture–the only application of commercial value–Letault returned to Paris by the specified time (15 April 1840) without having achieved his object, and the sum which the eventual buyer of the patent rights paid Daguerre after portraiture had become practicable fell far below the amount he had expected to receive. In fact the patent brought Daguerre little financial reward, while his reputation in England suffered considerable damage through it.

In consequence of the patent, the daguerreotype process gained a foothold only after portraiture had become practicable, and, even then, very few professionals were willing or able to pay the patentee's fee. Licences to amateurs were offered for 5 guineas, but evidently the process was too complicated and the outfit too expensive for anyone to consider daguerreotyping for amusement only. We have in fact not seen any English views, and the only views by an Englishman known to us were taken in 1840–41 by DR ALEXANDER JOHN ELLIS in Rome and other Italian cities, assisted by Achille Morelli and Lorenzo Suscipi. They were intended for a publication *Italy Daguerreotyped* which did not materialize on account of the expense of engraving the pictures.[8] Scotland and Ireland did not come under the jurisdiction of the patent, but amateurs in these countries used Talbot's calotype process, which was simpler and cheaper as well as un-patented there. The only exceptions known to us are some daguerreotypes taken by DR GEORGE SKENE KEITH, a Scottish doctor and brother of Dr Thomas Keith the calotypist (see p. 182), who accompanied his father on a visit to Palestine and Syria in 1844. Of the thirty daguerreotypes taken, including some in Petra, eighteen were published in 1848 as engravings illustrating his father's book.[9] This is the first, and as far as we know the only, British book to be illustrated with engravings copied from daguerreotypes.

On 13 September 1839 a Frenchman, M. de St. Croix, gave the first public demonstration of the daguerreotype process in England, at No. 7 Piccadilly, London. According to *The Times*, the demonstration was held in the presence of a select number of scientists and artists, and the picture produced was a street view 'resembling an exquisite mezzotint'.

At the same time the first (imported) daguerreotypes were offered for sale by a chemist named Robinson, of Store Street, Bedford Square, London, who was also the first to sell polished silvered plates for the daguerreotype process.[10]

Between 13 and 21 September 1839 appeared the first English edition of Daguerre's Fig 12 manual, translated by J. S. Memes. The demand was so great that it was at once reprinted and then went into a second and third edition, in spite of competition from three other translations published in London between the end of September and the end of November.[11]



HISTORY AND PRACTICE
OF
PHOTOGENIC DRAWING
ON THE TRUE PRINCIPLES OF THE
DAGUERRÉOTYPE,
WITH THE NEW METHOD OF
DIORAMIC PAINTING;
SECRETS PURCHASED BY THE FRENCH GOVERNMENT, AND BY THEIR
COMMAND PUBLISHED FOR THE BENEFIT OF
THE ARTS AND MANUFACTURES:

BY THE INVENTOR
L. J. M. DAGUERRE,
OFFICER OF THE LEGION OF HONOUR, AND MEMBER OF VARIOUS ACADEMIES.

TRANSLATED FROM THE ORIGINAL BY
J. S. MEMES, LL.D.
HON. MEM. OF THE ROYAL SCOTTISH ACADEMY OF FINE ARTS, ETC.

"As a recompense for giving the secret of this splendid discovery to the world, the French Government has just awarded an Annual Pension of Ten Thousand Francs!"

SECOND EDITION.

LONDON:
SMITH, ELDER AND CO., CORNHILL;
AND ADAM BLACK AND CO., EDINBURGH.
1839.

Fig 12 Title-page of first daguerreotype manual in English, translated by J. S. Memes, 1839

From early October 1839 onward, exhibitions of daguerreotypes and daily demonstrations of the process took place at the Royal Adelaide Gallery of Practical Science, West Strand, by M. de St. Croix, and at the Royal Polytechnic Institution, 309 Regent Street, by the resident chemist, J. T. Cooper. At these newly founded institutions demonstrations of applied science and exhibitions of curious natural phenomena afforded that typical Victorian blend of instruction and recreation so eagerly sought by the new enlarged middle class. It is amusing that the earliest public exhibitions of daguerreotypes and regular demonstrations of the process were sandwiched between such other novel attractions as an electric eel, a diving bell in which the public could descend into a 14-ft-deep reservoir, 'the Invisible Girl', safety signal lamps, working models of steam-engines and steam-guns, which must have been somewhat disturbing during performances on the new musical instruments, the Aeolophon and the Terpodion. It was a natural development that out of these demonstrations grew the first photographic studios in England, for these institutions drew large crowds whose curiosity, aroused by the lecture, led them to try the novel form of portraiture.

Soon came the disturbing realization that no one was allowed to take, demonstrate, exhibit, or sell daguerreotypes without a licence from the patentee, who obtained an injunction against M. de St. Croix at the end of October.[12] The Polytechnic Institution continued the demonstrations, having previously been licensed by Miles Berry.

This action may have been instigated by Antoine Claudet, who had just bought the first licence direct from Daguerre himself, and not unreasonably now wished to protect his newly acquired rights. ANTOINE FRANÇOIS JEAN CLAUDET, F.R.S., was a Frenchman who had settled in London in 1827 as an importer of sheet glass and cylindrical glass shades, which were not made in England until Chance & Co., the

Pl 57

well-known glass manufacturers in Birmingham, took up the idea in 1829. Claudet then opened showrooms at 89 High Holborn for the sale of 'plain and painted glass, and glass shades or domes for the Covering and Preservation of Statuettes, Wax Flowers, Alabaster and other Articles of Vertu'–those glass domes so familiar in Victorian interior decoration.

In the excitement of August 1839 Claudet's interests were diverted into other channels than glassware. As a businessman with imagination he realized the commercial advantages the new invention offered to those who lost no time in exploiting it. On the advice of his friend N. P. Lerebours, Claudet went to Paris in the autumn of 1839, received instruction in the manipulation from Daguerre himself, and bought from him direct for £200 the first licence to practise the daguerreotype in England.[13] If the British Government or some public institution should buy the patent and then make the invention available to everyone, Daguerre agreed to refund to Claudet the purchase money of the licence. If a private purchaser should be found, Claudet was to be given the first option at the price offered.

Early in 1840 Claudet imported from Lerebours daguerreotypes illustrating 'views of Paris, Rome and other cities, their public buildings, bridges, fountains, and monuments; also landscapes'. These he submitted to Queen Victoria and Prince Albert, who bought some of the best, and the remainder were exhibited at soirées of the Royal Society. Afterwards they were put on sale at the business premises of Claudet & Houghton in High Holborn 'at prices varying from one to four guineas and upwards, according to their perfection, and the expense attending their production by travelling to the distant countries from which many of the views are taken'.[14]

In addition to their glass business, Claudet and his partner were now the sole importers of daguerreotype cameras and accessories, and daguerreotypes for sale. The apparatus was supplied to 'all persons wishing to use the invention for amusement or experiment'[15] and to safeguard themselves against infringements their advertisements invariably contain the warning: 'The daguerreotype being protected in this country by Her Majesty's Royal Letters Patent, all apparatus and proofs not bearing the above names are infringements of the patent rights, and their owners will be liable to actions for damages.'

For some months the daguerreotypes offered for sale were mostly continental views, but on 18 July 1840 we hear for the first time of London views, and these were doubtless taken by Claudet himself. The same advertisement includes 'portraits from nature', 'figures from the living model', and 'microscopic objects immensely magnified'. A daguerreotype *portrait* was such a curiosity during 1840 and the early part of 1841 that people were willing to buy portraits of strangers–in all probability professional artists' models used to posing without moving and able to endure the necessary ten to fifteen minutes' exposure.

At this period the sensitivity of the daguerreotype plate was still too small to make its application to portraiture in general a practicable proposition, and this applied to England no less than to France and other continental countries. Only in America were fairly short exposures possible, owing partly to the brightness of the light, and partly also to the adoption of Wolcott's ingenious studio arrangement with reflecting mirrors and the introduction of his camera with a concave mirror instead of a lens. Elsewhere, chemists and opticians were trying to reduce the exposure to a reasonable time either by accelerating the chemical part of the operation or by constructing faster lenses, for the Daguerre cameras, manufactured by Giroux & Cie., were fitted with Chevalier's achromatic meniscus lens,[16] and this was very slow, working at an aperture of about F.14. It was with such a camera that Claudet was taking experimental portraits on the sunny spring days, on the roof of the Adelaide Gallery, when RICHARD BEARD opened the first professional portrait studio in Great Britain (which was probably also the first in Europe) at the Royal Polytechnic Institution on 23 March 1841. To Beard, originally a coal merchant in Earl Street, Blackfriars, photography was merely a speculation, a means of getting rich quickly.

Exactly a year before, William Carpmael, Beard's partner in a patent agency, had introduced Beard to William S. Johnson (father of John Johnson), who had just arrived from the States for the purpose of marketing in Britain Wolcott's mirror camera already referred to. Beard reached an agreement with Johnson and on 13 June 1840 took out a patent for Wolcott's camera, an American patent having been granted to Wolcott on 8 May. 'Beard paid Johnson £200 and expenses for one-half of the American invention: the remaining half, with all profits, he purchased for £7,000 at twelve months from the issuing of the patent.'[17]

As neither Beard nor Johnson senior knew anything about photography, in June they engaged JOHN FREDERICK GODDARD, science lecturer at the Adelaide Gallery, 'to apply his scientific knowledge to the improvement of the process'. This refers to the use of bromine as an accelerator, for according to John Johnson, Alexander Wolcott had experimented with this substance–though unsuccessfully–early in 1840. In fact, this important accelerating agent was already incorporated in Beard's patent of 13 June 1840 as 'An improved mode of treating the surfaces of prepared silver plates by submitting them to the chemical action of iodine and bromine or bromic acid combined, instead of treating them with iodine only. By the employment of this combination of iodine and bromine the surfaces of the silver plates *are said to be* (authors' italics) rendered more sensitive to the action of light, and the operation of obtaining perfect images greatly facilitated, whether performed by reflection from a mirror or through a lens.'[18]

During the summer and autumn of 1840 Beard, Goddard, and 'other gentlemen of high scientific attainment' experimented with portraits from life at an establishment at Medical Hall, near Furnival's Inn, Holborn.[19] In September a likeness could be taken in from 1 to 4 minutes for portraits varying from the size of a sixpence (for bracelets, lockets, etc.) to that of an ordinary miniature. The previous month the exposure had still averaged 5 to 6 minutes. 'The features are admirably marked out,' wrote the *Morning Chronicle* on 12 September, 'and are perfectly correct whatever may be the size in which they are taken, as they are all reduced in proportion. The eyes appear beautifully marked and expressive, and the iris is delineated with a peculiar sharpness, as well as the white dot of light on it.' The sunlight was directed on to the sitter by large movable reflectors fixed outside the window, identical with the arrangement adopted in Alexander Wolcott's Daguerrean Parlor in New York.

When Miles Berry heard of these activities he threatened legal action. Beard and Johnson argued that they employed 'the American photographic process' and not Daguerre's, but finding the patent agent unrelenting they paid him £150 p.a. for the right to daguerreotype with their mirror camera. The licence did not cover the use of Daguerre's camera.

As the autumn days became darker and exposures longer, Goddard redoubled his efforts at hypersensitizing the daguerreotype plate by exposing it to the fumes of bromine and iodine combined, instead of iodine alone as specified by Daguerre, and eventually he succeeded by his method in speeding up the process considerably. It is uncertain whether Goddard was assisted in these experiments by John Johnson, who was sent for by his father and reached London early in November, but all available evidence points to *Goddard's* discovery, published in his letter to *The Literary Gazette* of 12 December 1840. Experiments continued during January and February 1841, when the exposures were reduced to 2 minutes 10 seconds. Goddard's diary[20] also establishes that he was at that time still only practising on members of the firm and his father. Portraits of William Johnson and of Goddard's father, taken respectively on 12 and 16 February, were shown at a meeting of the Royal Society on 18 February.

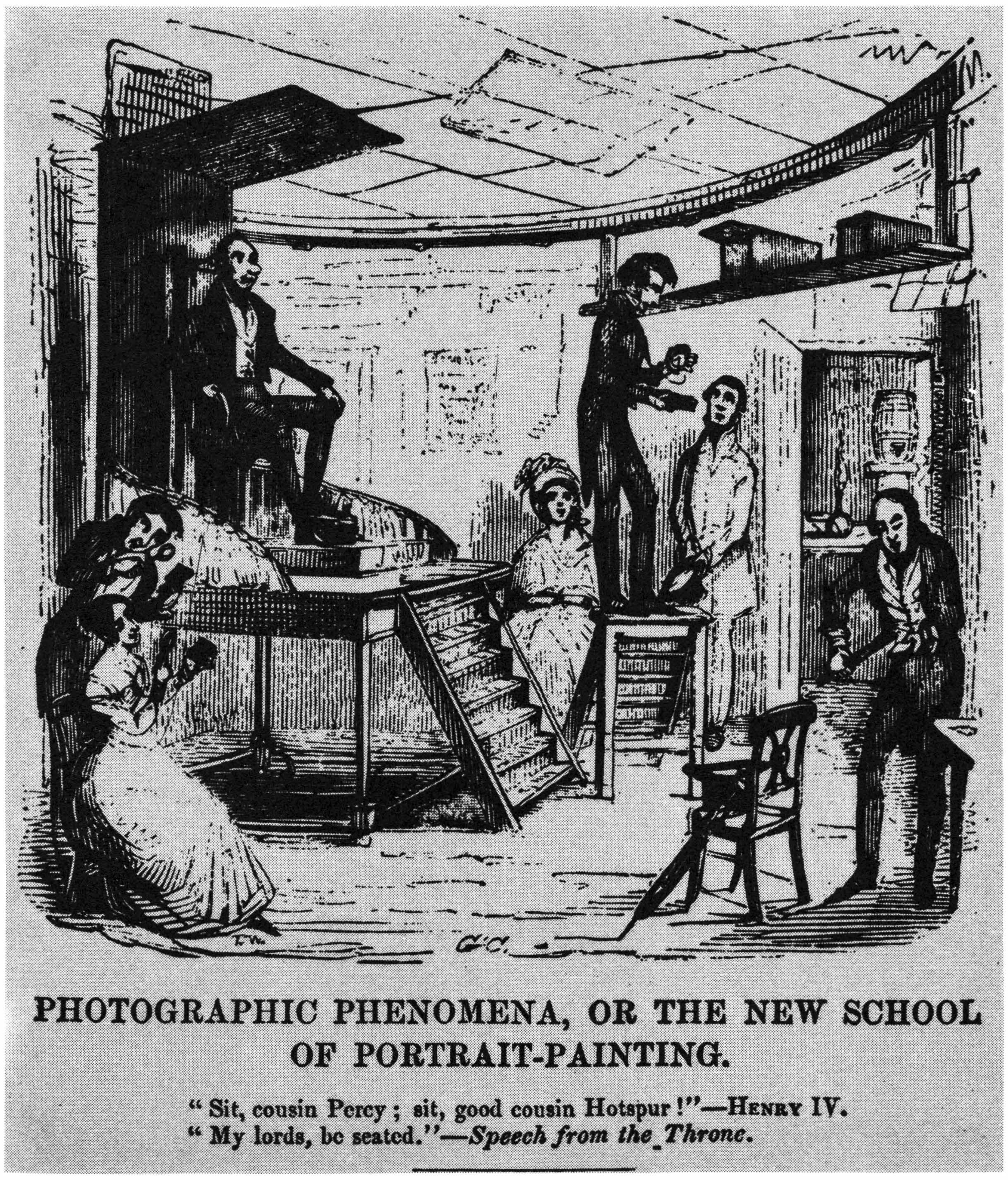
Confident that exposures would be still shorter in the brighter spring and summer days, John Johnson went ahead in arranging the first *public* studio, which was erected on the roof of the Royal Polytechnic Institution, and overlooked Cavendish Square. It was opened on 23 March 1841, with J. T. Cooper and Goddard as operators, and exposures varied between 3 seconds and 2 minutes, according to the weather[21] and the size of the picture. Francis S. Beattie,[22] an Irish engraver who was taken on as temporary operator in October 1841, said the exposure was 3 to 5 minutes.

Much excitement was aroused in London by the novelty of having one's likeness taken by 'the sacred radiance of the Sun' and crowds flocked to Beard's establishment. 'In the waiting rooms you would see, awaiting their turn to enter the blue glass roofed room, the nobility and beauty of England, accommodating each other as well as the limited space would allow, during hours of tedious delay.'[23]

The studio was circular so that the sitter could be made to face the sun at any time Fig 13 of day, and the posing-chair was on a raised platform, to bring him closer to the light.

> All the objects in the room have a bluish colour, which at first seems strange to the eye, but one soon gets used to it [wrote a reporter]. The person wanting to be portrayed is seated on a high comfortable chair, with his face turned towards the sun. The head is fixed with a kind of neck-iron. Opposite the sitter stands a big square box in which Mr Wolcott is hidden with his daguerreotype. He calls out to the 'patient' to put on a cheerful expression, and hardly is the latter ready with his grimace, than his image is already fixed on the silver plate with a surprising likeness. Before you have recovered from your astonishment at the wonder of physics, the picture is fixed by a chemical process; beautiful frames of every size and price are in stock, and before five minutes have passed, the visitor receives his *cara imagine* excellently carried out and nicely framed.[24]

The earliest Beard photographs are tiny, usually 1½ in. × 2 in., and contained in little pinchbeck cases, or black papier-maché frames of the kind used for silhouettes. The metal cases are embossed on the back with the Royal coat-of-arms (signifying the Royal Polytechnic Institution, for Beard was never appointed photographer to the Pl 54 Queen) and the name of the case-maker and date of his patent, 'T. Wharton. No. 791, 24 August 1841.' Each daguerreotype is protected by glass, with an oval or rectangular gilt matt – usually bearing the words 'Beard Patentee' – interposed. The matt has the double function of preventing the glass from rubbing on the daguerreotype and of framing the portrait. The whole 'sandwich' is set in the pinchbeck case, the edges of which are turned over, sealing the daguerreotype from dust and air, which would oxidize the silver. The pinchbeck case in turn is inserted in a dark red morocco leather case lined with red velvet. Daguerreotypes in black papier-maché silhouette-frames are considerably rarer; these, too, bear a distinctive mark of their origin: the words 'Beard Patentee' are embossed on the setting of the hanging-ring, and on the back of the frame is affixed Beard's label. The earliest British daguerreotype which we have so far been able to find is of a lady with low-cut bertha. This portrait, dated Pls 52, 53 1842, and another of about the same date measure 1½ in. × 2 in., and are now in the Gernsheim Collection.



PHOTOGRAPHIC PHENOMENA, OR THE NEW SCHOOL OF PORTRAIT-PAINTING.

"Sit, cousin Percy; sit, good cousin Hotspur!"—HENRY IV.
"My lords, be seated."—*Speech from the Throne.*

Fig 13 George Cruikshank. Woodcut of Beard's studio, 1842

Fig 13

George Cruikshank caricatured Beard's studio in a woodcut illustrating a poem on 'The New School of Portrait-painting' by S. L. Blanchard.[25] Only a short extract can here be given from the amusing poem, which runs to several hundred lines:

Like the crowds who repair
To old Cavendish Square,
And mount up a mile and a quarter of stair
In procession that beggars the Lord Mayor's show!
And all are on tiptoe, the high and the low,
To sit in that glass-cover'd blue studio;
In front of those boxes, wherein when you look,
Your image reversed will minutely appear,
So delicate, forcible, brilliant and clear,
So small, full, and round, with a life so profound,
As none ever wore
In a mirror before. . . .
His [Apollo's] agent on earth, when your attitude's right,
Your collar adjusted, your locks in their place,
Just seizes one moment of favouring light,
And utters three sentences–'Now it's begun'–
'It's going on now sir'–and 'Now it is done'.
And lo! as I live, there's the cut of your face
On a silvery plate
Unerring as fate,

Worked off in celestial and strange mezzotint
A little resembling an elderly print.
'Well, I never!' all cry; 'it is cruelly like you!'
But Truth is unpleasant
To prince and to peasant.
You recollect Lawrence, and think of the graces
That Chalon and Company give to their faces;
The face you have worn fifty years doesn't strike you!

Excited though the crowds were, Beard was still more so. Business was beyond his wildest dreams; the average takings each day are said to have amounted to something like £150.[26] This figure, however, in all probability refers only to the enthusiastic onrush of the first few months, when a daguerreotype portrait was a great novelty, for N. P. Lerebours in November 1841 remarked[27] that the receipts at Beard's and Claudet's establishments in the early days 'several times amounted to £60 in one day'. Whatever the exact amount, the takings were undoubtedly very high, and Beard, realizing the fortune that lay within his grasp if he could secure a monopoly in photographing 'the human face divine', on 23 June 1841 purchased from Miles Berry the whole of the daguerreotype patent for £800, thus becoming the sole patentee in England, Wales, and the Colonies. £800 for the right to hold a monopoly of the daguerreotype for the remaining twelve years of the patent seems a trifling sum when we remember that only the year before Daguerre had expected to obtain five times that amount, and considering that Beard had paid over £7,000 for the right to use Wolcott's camera, which was in fact abandoned within only two years.

In accordance with the arrangement made between Daguerre and Claudet in 1839, the patent was first offered to Claudet, but he could not afford it, and his partner, sceptical about the value of the investment, could not be persuaded to finance the project. In the years to follow, George Houghton must have greatly regretted his decision, for Beard is said to have taken between £25,000[28] and £36,000[29] in the second business year alone from the sale of licences and fees from his professional studios.

Since the summer of 1840 Claudet, like Beard, had busied himself trying to find a means of accelerating the daguerreotype process; but, unable to avail himself of either Wolcott's camera or Goddard's accelerator bromine, Claudet found a solution to the problem only two months after Beard had started business. It was in May 1841 that he made the discovery that a combination of chlorine and iodine vapour greatly increased the sensitivity of the plate. He communicated this accelerating process to the Royal Society on 10 June, a report to the Académie des Sciences in Paris having been read three days earlier.[30] The exposure was comparable with Beard's, varying between 10 seconds and 2 minutes according to the strength of the sunlight, the time of day, and the season of the year. It is astonishing how greatly the exposure varied from month to month: 'In June I operated in 10–20 sec., in July in 20–40 sec., in August in 40–60 sec., and now in September in 60–90 sec.'[31] Claudet made the process freely available to everyone. It constituted perhaps the most important chemical advance in perfecting the daguerreotype, after the improvement introduced by Hippolyte Fizeau of Paris in August 1840. And just as every daguerreotypist in the world availed himself of Fizeau's process, which was not patented, so Claudet's improvement was now eagerly taken up.

The same month (June 1841) Claudet began to take portraits professionally in the 'glass-house' he had erected for experimental work some time in 1840 on the roof of the Adelaide Gallery, just behind St Martin's-in-the-Fields.[32] Glazed with blue glass, the studio was used only in cold or rainy weather; on fine days the sitter was posed in the open air under an awning to screen the face from the glare of sunlight.

> In that year (1841) I remember having my daguerreotype portrait taken by M. Claudet on the roof of the Adelaide Gallery [wrote Thomas Sutton]. I was seated one sultry summer afternoon at about three o'clock, in the full blazing sunshine, and after an exposure of about a minute the plate was developed and fixed with hypo. My eyes were made to stare steadily at the light until the tears streamed from them and the portrait was of course a caricature. It has since faded. I paid a guinea for it. M. Claudet himself superintended the pose, and an assistant, a mere youth, prepared and developed the plate. . . . In conversation with M. Claudet about the wonderful art which he practised, he informed me, with the utmost gravity, that to achieve anything like success or eminence in it required the chemical knowledge of a Faraday, the optical knowledge of a Herschel, the artistic talent of a Reynolds or a Rembrandt, and the indomitable pluck and energy of a Hannibal; and under these circumstances he strongly dissuaded anyone from taking it up as an amusement.[33]

As soon as Beard heard of Claudet's activities he tried to get rid of his rival, and on 15 July obtained an injunction restraining him from taking daguerreotypes. Beard based his case on the clause in Claudet's agreement according to which he was to receive back the value of his licence in the event of the patent being sold outright to another party. In court Beard stated that Miles Berry had tendered Claudet £200 for the repurchase of his licence and had called upon him to assign it to Beard. Claudet refused, contending that the wording of the clause did not make it compulsory on him to *resell* his interest, though it did impose an obligation on the patentee to tender the £200 for its *repurchase*. It is impossible to judge whether Claudet was morally bound to relinquish his licence even though the wording of the agreement left him a loophole, or whether he was indeed only insisting on his right. At any rate, the High Court of Chancery accepted Claudet's contention and exactly a week later the injunction was dissolved. Beard appealed against this judgement at the Court of Queen's Bench in June 1842, and at the Court of Exchequer in 1843, but each time the High Court's decision was upheld. So the anomalous situation existed that although Beard was sole patentee of the daguerreotype, he had no control over Claudet's roof, which established itself as a new meeting-place for friends, families, and parties. 'By his improved process Mr A. Claudet is enabled to take groups of three to six persons either engaged at tea, cards, chess, or in conversation, affording whole-length family portraits, or of friends, arranged in any manner most agreeable to the parties.'[34] The possibility of taking several portraits simultaneously was a great novelty to people who, thinking in terms of miniatures and silhouettes, believed that it would take several times longer than a single portrait.

Nevertheless, for the first eight to ten months Claudet's portraits were technically inferior to Beard's, one of the chief drawbacks being the lateral reversal of the portrait, which did not occur with Wolcott's mirror camera. Having the advantages of the practical experience gained by Wolcott and Johnson in New York, and many months of Goddard's experimental work at Medical Hall, Beard's pictures were said to be superior 'in fidelity of resemblance, delicacy of marking, and clearness of effect'.[35] Fully aware of these defects, Claudet put a reversing prism in front of the lens, and advertised that 'Having always adopted the practice of exchanging for better portraits those which have not been satisfactory, all persons exhibiting first portraits taken at his establishment will be entitled to duplicates at half price.'[36] The price of a single portrait was from 1 guinea upwards.

In August 1841 Claudet announced that 'By a new application M. Claudet is enabled, *without any additional charge*, to fix the portraits and render them so durable that they will not fade nor turn black.'[37] One wonders what the earlier portraits were like! Claudet was not the only photographer to experience this difficulty as we shall see.

With the intention of distinguishing his establishment from Claudet's in the public mind, Beard designated his pictures 'Patent photographic likenesses taken by Wolcott's reflecting apparatus' and adopted the term 'Photography' on the ground that this is 'a name better suited to the principles of English nomenclature than that of daguerreotype, which, although a favourite word on the Continent, is by no means suited to our views, as it has no reference whatever to the principles of the subject'.[38]

In July 1841 Beard and John Johnson were joined by Alexander Wolcott, who arrived in London in order to superintend the manufacture of equipment required for other projected studios, and for this purpose a factory at 1 Wharf Road, City Road, was taken over. Encouraged by the excellent business at the Polytechnic Pl 55 Institution, in 1842 Beard opened two more studios in London, at 34 Parliament Street, Westminster, on 29 March, and a month later, at 85 King William Street, City.[39]

Simultaneously with the opening of the new London studios began the establishment of a number of studios in the provinces: at Liverpool (Mount Gardens, St James's Walk) in September 1841, with John Relph as studio manager. The photographic company paid Beard £2,500 for the licence for Liverpool and ten miles around; the building was erected on land granted by the Corporation.[40] Later a second establishment was opened at 34 Church Street, Liverpool. Photographic Institutions were also opened at Southampton in October 1841,[41] and at Brighton on 8 November 1841.[42] The proprietor of the latter, on the Marine Parade, was WILLIAM CONSTABLE, who took the earliest photographic portrait of Prince Albert on 6 March 1842. William Constable remained the only professional photographer in Brighton for the next ten years, and during this period many distinguished people sat to him, including the Duke of Devonshire and the Duke of Parma. In Manchester a studio was opened at the Exchange on 18 November 1841[43] under the management of Richard Nicklin. Lastly, we know of one at the Royal Bazaar, Norwich. Beard's name does not, however, appear in connection with all these provincial studios for he sold each business when completed, with the licence, which was sometimes for a town only, and at others extended to one or several counties. In this way, Beard assigned to John Johnson 'the sole and exclusive right and privilege of using and exercising the Daguerreotype invention in the taking of likenesses, or other representations, in the counties of Lancashire, Cheshire and Derbyshire' on 9 November 1842.[44]

For Beard photography had become big business. To show how profitable portraiture was, Beard confidentially explained his price list in a circular letter to prospective licensees. The very large gains that lay within their grasp was the most obvious inducement (see table opposite). The remark about colouring probably meant that Beard would make no extra licence charge for colouring daguerreotypes, which he had also patented in March 1842.

It is almost certain that he bought the method, possibly through a third person, from the Swiss painter and daguerreotypist J. B. Isenring, who was the first to perfect

PROFITS ON PORTRAITS

Charge	*Profit*
1 guinea (for a bust)	*about* 18*s*
30*s* (slightly larger size)	.. 25*s*
2 guineas (full-length)	.. 34*s*
4 guineas (a miniature painted *from* a daguerreotype)	.. 70*s*

exclusive of the charge of 5*s* for colouring each portrait, 'the cost of which is not a penny'.[45]

a process of colouring daguerreotypes and then immediately sold it to an English chemist named Poppet (Robert Porret?) on 17 January 1842. A condition of the contract was that Isenring, who was one of the earliest professional portraitists on the Continent, must refrain from using his method for the next eight months.[46] The purpose of colouring daguerreotypes was, of course, to make them more acceptable to the taste of the public, who, being accustomed to miniatures, objected to the metallic glare of the new portraits, which they understandably found lacking in warmth and life.

The process was rather complicated and demanded great skill. A tracing of the portrait was made on glass, and from this, a tracing-paper stencil was made for each different colour. The dry powder colour, which contained a little gum arabic, was shaken on over the stencil. An alternative method was to apply the powder by means of a fine camel-hair brush. The colours were fixed to the metal by gently breathing on them, which dissolved the gum arabic.

Unable to use Beard's patented method, Claudet, in 1845, entered into collaboration with a well-known French miniature painter, L. Mansion,[47] who coloured and copied daguerreotypes, producing 'the most exquisite paintings on ivory, having, with the exact truth of the photograph, all the charm, colour and life of a miniature'. The production of daguerreotypes in natural colours occupied the minds of scientists and writers for many years, until in 1847 Claudet startled the scientific world by his pronouncement that the nature of the daguerreotype precluded the possibility of ever fixing the natural colours.[48] The ensuing controversy was not settled in Claudet's favour, but in years to come his statement was borne out by experience. Colouring by hand was all that could be done.

Another idea designed to relieve the plainness of daguerreotypes and to enhance their pictorial effect was the use of backgrounds of painted scenery representing trees, architecture, or a library. These backgrounds were introduced by Claudet, who from the moment he took up photography devoted himself ardently to its improvement and progress as science and art.

Needing some better means of controlling the degree of development of the exposed plate, which had so far–like the preparation of the plate–to be carried out in semi-darkness, Claudet became the originator of the photographic darkroom light and on 18 December 1841 patented the idea that all operations upon the daguerreotype plate should be performed in a room illuminated by a red light, the colour of which did not affect the sensitive plate. He also constructed a camera in which the development with mercury vapour was carried out *inside* the box itself, without having to resort to a darkroom, the camera being fitted with a red window to allow the photographer to watch the progress of the development. Claudet does not seem to have enforced his patent rights, however, for both darkroom light and painted backgrounds (included in the same patent) soon became part and parcel of photographic studios everywhere.

If for the first ten months or so Claudet's daguerreotypes were inferior to those from the studios of his rival, by the middle of 1842 they were regarded as having Pl 56 surpassed Beard's technically as well as artistically. In July 1842 several members of the *corps de ballet* at the Italian Opera posed for their portraits 'in postures that could be retained but for an instant, such as poising on one toe with the other leg extended, and resting on the points of both feet', and these pictures caused a sensation, being mistakenly regarded as the first 'instantaneous' photographs ever taken.

The appearance of the world's first illustrated weekly, *The Illustrated London News*, on 14 May 1842 may have been influenced by the new art of photography. At any rate, the proprietors promised in their first issue that every reader who took the paper regularly for six months would receive 'A grand panorama print of London, a picture bigger than anything previously issued', and they guaranteed the fidelity of the panorama to the actual London scene, for the engraving was to be 'drawn by the light of the sun'. Such newspaper offers are familiar enough to us, but must have seemed startling in 1842. Claudet was the photographer entrusted with this task. With a specially built camera he took a large number of views from the top of the Duke of York's Column in Pall Mall. An artist copied the daguerreotypes by pencilling the outlines of the buildings and trees on to sixty separate pieces of boxwood, and the picture was cut by nineteen engravers working in shifts day and night for two months. Finally the pieces were bolted together to form one huge printing block showing two views, one looking north, the other south. The engraving, published on 7 January 1843, was gigantic, measuring 50 in. × 36 in., and it consolidated the photographer's fame as well as that of the new weekly. Thereafter *The Illustrated London News* relied to a large extent on the new art for its illustrations, chiefly portraits at first, by the leading photographers of the day.

At the beginning of 1843 Claudet went to Paris for several months to take portraits of a number of notabilities, including King Louis-Philippe, and to acquaint himself with the latest improvements. The most important was the Petzval lens, which was much faster than any previous lens, and consequently permitted the taking of larger portraits than before. When Claudet returned to London in May 1843 he made known that 'he is now enabled to take likenesses of a much larger size upon plates 6½ × 8½ inches, and even of the extraordinary dimensions of 16 × 13 inches [against the previous limit of 2½ in. × 3 in.]; and nothing can be more striking than the effect produced by these enlarged portraits. M. Daguerre has personally communicated to M. Claudet his latest discoveries, by which the process is much improved.'[49] These facts were not lost upon the public, and the famous and the rich soon crowded Claudet's establishment.

To hold his own Beard also was now forced by circumstances to employ the Petzval lens. With the initial advantage of the mirror camera–speed–gone, its defects, compared with the usual construction of a camera with a lens, became apparent. The reflected image was rather 'soft', and the placing of the plate between sitter and mirror limited the picture area to 1¾ in. × 2¼ in. A larger plate size would have screened the aperture too much and at once lengthened exposures, besides causing other faults. Moreover, the concave mirror gave a slightly distorted image, larger at the circumference and smaller at the centre. Wolcott's mirror camera was therefore abandoned.

The fact that the daguerreotype picture was on metal and hence did not lend itself to the production of copies had from the earliest days of the invention been regarded as a great drawback to the process, as compared with the calotype. Though it was the practice in both Claudet's and Beard's studios to overcome this difficulty by taking two portraits simultaneously with two cameras, or two in succession with the same camera,[50] this was not an altogether satisfactory solution, since the two pictures were never exactly the same, and usually sitters wanted additional copies. Some also liked their portraits in larger dimensions than the Wolcott camera could take. Electrotyping or engraving daguerreotypes was difficult, and even when successful the copy was of an entirely different nature from that of the original. Claudet solved the problem in 1842 by having a camera made for taking several portraits on one long plate, by means of a repeating back, and cutting up the plate afterwards into the separate portraits. He exhibited these 'multiple portraits' as he called them, at the Exposition des Produits de l'Industrie Française in Paris, 1844.[51]

Wolcott and Johnson attempted to solve the problem of copies on different lines, but whether the apparatus which they patented in March 1843 and installed at Beard's studios was employed to any extent is difficult to say. At any rate, 'copies of daguerreotypes of an Enlarged or Diminished size from the plate on which any portrait or other image has been taken' were still advertised by Beard in 1847, though the difficulty of size had long been overcome by the Petzval lens. According to the patent specification, the enlarged photograph could be 'the size of life', and could be either on a daguerreotype plate or on sensitized paper. For this reason, Beard acquired a calotype licence from Talbot in 1842.

By 1844 Claudet's establishment on the roof of the Adelaide Gallery had become too small and he transferred his studio to the top floor of the adjoining corner house, which communicated with the Adelaide Gallery and also had its own private entrance at 18 King William Street. Optics and chemistry combined had speeded up the daguerreotype process to such an extent that Claudet could announce: 'The operation can be performed in any weather, and the sunshine is not at all necessary, as the portraits are always taken in the shade, in which persons can better preserve a natural and pleasing expression of countenance.' Nevertheless he advised clients 'to avail themselves of the present favourable season [October] before the prevalence of fogs, during which photographic operations are less successful', adding, 'the early hours of the day are generally most favourable'.[52]

At this new studio Claudet followed Beard's example and provided a waiting-room 'specially for ladies, who can avail themselves of the attendance and attention of a respectable female'. Realizing that the aesthetic effect of daguerreotype portraits depended in a large degree on the dress of the sitter, garments suitable in shape and colour were provided at Beard's and Claudet's establishments, but fastidiousness and individual taste caused most sitters to object to wearing dresses that had clothed others before. For their guidance, advice on what to wear seemed essential.

> *Hints on sitters' dress and expression*
>
> Avoid pure white as much as possible. Some ladies dress themselves out in snowy berthas and spotless wristbands; but many a good picture is spoiled by the spottiness occasioned by the powerful action of this colour upon the plate. Violets have also the same effect upon it. A lady takes her sitting in a purple dress and is astonished to find herself in a white muslin in her portrait, this particular colour acting even more intensely than the pure white upon the prepared silver. The very best kind of dress to wear on any such occasions is a satin or a shot-silk, or any material, in fact, upon which there is a play of light and shade. Plaids always look well; and an old tartan shawl thrown across the shoulders and well composed as to folds

> would form an admirable drapery, but this is an artistic liberty which ladies are very loath to submit to. . . .
>
> We wish ladies would be a little less prim on such occasions. It is quite melancholy to see the care they take to brush their hair, and apply that *abomination* fixiture [*sic*], to make it 'look nice'; whereas if a good breeze had broken it up into a hundred waves, the effect in the daguerreotype would have been infinitely more beautiful. And let them by all means abjure the system of making up a face for the occasion. The effect is painfully transparent. The mouth, so expressive in all faces, in these portraits is nearly always alike; and for the simple reason, that we put its muscles into attitudes which are not at all natural to it–we substitute a voluntary for an involuntary action; and of course stiffness is the result. If ladies however, *must* study for a bit of effect, we will give them a recipe for a pretty expression of mouth–let them place it as if they were going to say '*prunes*'.[53]

Among the many distinguished people whom Claudet photographed about this period were the inventors of photography, Talbot (1844) and Daguerre (1846), the Dowager Queen Adelaide and the Duke of Wellington (both in 1845), the Duke and Duchess of Northumberland, and the Duke of Richmond. The Duke of Wellington's portrait–the only photograph for which he ever sat–was by general consent the best likeness of him, and this portrait was subsequently copied in innumerable engravings and miniatures. Pl 32

On 5 April 1847 Claudet opened another portrait studio at the Colosseum in Regent's Park. This building, reopened in 1844 with a panorama of London, 400 ft long × 100 ft high, by E. T. Parris, and a permanent exhibition of sculpture, became within a short time one of the focal points of attraction in London, and was therefore a most favourable situation for a portrait studio. Claudet noticed an additional advantage–'the atmosphere of that locality being free from smoke will greatly facilitate the photographic operations'.

We have already referred to the retarding effect on the progress of photography caused by Beard's and Talbot's patents, which lasted for fourteen years from the date of issue. It is difficult to describe the general resentment these patents caused. Many people were tempted to take up photography without a licence, claiming that these processes had only become practicable and profitable through the many improvements of later investigators, and that the processes as practised in, say, 1843 or 1844 by then resembled the specifications of the original patent only in their fundamental principles.

Richard Beard–like Fox Talbot–brought several lawsuits against infringers of his patent. From time to time he published warnings threatening with immediate legal proceedings any person not duly licensed, adding, 'Information, with necessary proofs, relating to infringement, will be liberally rewarded', and since it was not always easy to prove infringement, Beard tried to get evidence by employing an *agent-provocateur*.

The most important case is that of *Beard* v. *John Egerton* of Temple Street, Whitefriars, which occupied the courts on and off for five and a half years, and is the longest lawsuit in the history of British photography.

Egerton was an agent for Daguerre's and Claudet's cameras, and for Voigtländer's and Lerebours's lenses, and became known for his English translation of Lerebours's *Treatise on Photography* (1843). Co-defendants in the case were Egerton's brother Jeremiah and Charles Bates, of the same address, who were described as plumbers and painters.

Beard was informed by his *agent-provocateur*, whom Egerton agreed to instruct in the process for the sum of £3, that Egerton and his companions followed the directions in the patent specification. Other people who had also called on them were likewise offered instruction. Thereupon Beard obtained an injunction in the High Court of Chancery, in February 1845, restraining Egerton from taking daguerreotype portraits, selling the apparatus, or teaching the manipulation.

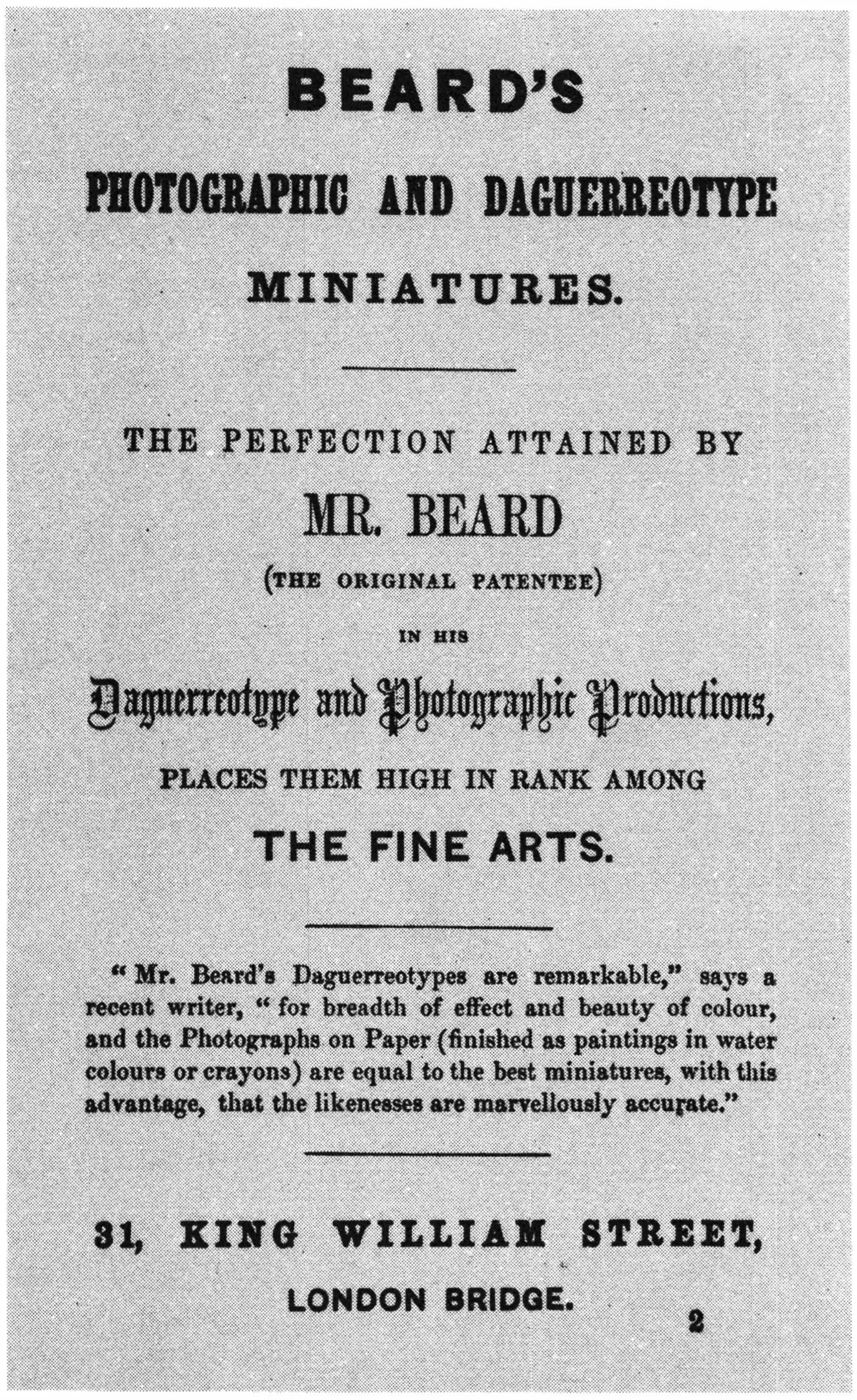
On 2 June 1845, however, the injunction was dissolved after three days' hearing on a technical point – Beard had concealed from the Court the fact that he had known about the infringement of his patent for over a year. Yet the judge directed that Beard should bring an action at law, and gave him power to inspect the defendants' apparatus. This was done, J. T. Cooper being one of the inspectors; but the inspection was obstructed by the defendants and Jeremiah Egerton threatened Cooper with force. Though Egerton sent Beard a letter of apology and offered to submit to a second inspection, this was equally undecisive, for on this occasion the liquids in the bottles were so diluted that Cooper could not apply any effective tests. Subsequently the bottles were admitted not to be the same as those used before, so it is not surprising that in such circumstances the attempt at inspection was abandoned.

To rally public support for Egerton, Jabez Hogg, an ophthalmic surgeon and a keen microscopist and amateur photographer, published anonymously a booklet entitled *Photography Made Easy*. It contained *inter alia* 'The injustice and validity of the patent considered, with suggestions for rendering such a patent a virtual dead letter', and gave details of the lawsuit.

When the case was resumed in April and May 1846, Egerton challenged the validity of the patent. Failing to get it set aside on the ground that it should never have been granted – a feeling generally held in scientific circles in England – Egerton then found fault with the details of the specification, to which he entered fifteen points of objection. On 2 July 1847 judgement was given in favour of Beard on fourteen points with an award of 40 shillings damages, but on the fifteenth – that the ambiguous wording of part of the patent rendered the specification insufficient – judgement was entered for Egerton. This decision was confirmed on 1 July 1848, but on 20 January 1849 the judges reconsidered the case, now in its fifth year, and came to the conclusion that the objection to the wording could not be sustained as the description was 'sufficiently clear to be understood by an operator of fair intelligence'. Therefore on this point, too, Egerton's objections were finally overruled and a verdict entered in favour of Beard and made absolute on 25 June 1849. The official report occupies no less than fifty-one pages. Four days after the validity of the patent was re-established, Richard Beard and his former partner John Johnson of New York independently issued warning notices in the press against further infringements of their patent and licence rights respectively.[54]

This matter has been discussed in detail in order to demonstrate that the daguerreotype patent was *not* set aside, as has been stated by Sir David Brewster[55] and other writers who repeated his error. The patent ran its normal course of fourteen years and expired on 14 August 1853.

Just over three months after winning his case, on 8 October 1849 Beard applied for a certificate of bankruptcy, granted on 5 June 1850. This and other lawsuits were Beard's ruin. Apart from the costs of the protracted litigation, the sale of licences, which had brought in large sums in the first few years of the patent, ceased.[56] The year 1845 was the turning-point in his short-lived fame and fortune. However, bankruptcy did not terminate Beard's photographic career. In 1851 he introduced 'enamelled' daguerreotype portraits, an improvement, it was claimed, whereby the



BEARD'S

PHOTOGRAPHIC AND DAGUERREOTYPE

MINIATURES.

THE PERFECTION ATTAINED BY

MR. BEARD

(THE ORIGINAL PATENTEE)

IN HIS

Daguerreotype and Photographic Productions,

PLACES THEM HIGH IN RANK AMONG

THE FINE ARTS.

"Mr. Beard's Daguerreotypes are remarkable," says a recent writer, "for breadth of effect and beauty of colour, and the Photographs on Paper (finished as paintings in water colours or crayons) are equal to the best miniatures, with this advantage, that the likenesses are marvellously accurate."

31, KING WILLIAM STREET,

LONDON BRIDGE.

2

Fig 14 Advertisement of Beard's daguerreotype and calotype studio, c. 1855

picture was rendered *entirely* impervious to atmospheric action, thus obviating the daguerreotype's liability to tarnish by oxidation. In 1852 Beard's studio No. 1 at the Polytechnic Institution was to let; the second establishment, in Parliament Street, was taken over soon afterwards by another photographer, John Watkins; the business in Liverpool was taken over by its former manager, James F. Foard. Beard Fig 14 retained only his studio in King William Street (London Bridge), which had been for some years under the management of his son Henry.

While Beard moved down in the world, Claudet moved up. In 1851 he gave up his principal establishment in King William Street (now William IV Street) and moved to 107 Regent Street, the southern end of which, around Vigo Street and the Quadrant, was almost monopolized by photographers: their 'glass-houses' gave Glasshouse Street its name.

In Regent Street Claudet set up a 'temple to photography' after his own heart. He engaged Sir Charles Barry, architect of the Houses of Parliament, to reconstruct the existing building in Renaissance style. The ground floor contained showrooms and store-rooms, the first floor darkrooms and offices, the second floor waiting-rooms, artists' rooms, and the studio. The waiting-rooms were decorated by a French artist, Hervieu, with paintings illustrating the history of photography. Here the visitor learnt that photography is the outcome of the labours of philosophers all through the ages. Looking around he saw fourteen medallion portraits of men who promoted the science of photography and stereoscopy, from Roger Bacon to Sir David Brewster. Allegorical paintings described the progress of the arts–sculpture, painting, engraving, lithography, and the application of the camera obscura to photography and of photography to the stereoscope. The discovery of photography in France and England was commemorated by large wall-paintings, and the series was completed by other allegorical allusions to the paper, metal, and glass used in the various photographic processes. Finally, mural scrolls recorded chronologically the inventions and discoveries to which photography is indebted. Claudet made his studio the most elegant and luxurious establishment of its kind in Britain.

> The most notable thing about his sitters is that they all seem to be gentlemen and gentlewomen. What Lawrence did with his brush, M. Claudet appears to do with his lens; he catches the best aspect of his sitter, and does full justice to nature. His female portraits have a grace and a delicacy which we have never seen before in Sun-portraits, his men too, show blood; and these advantages are secured without loss of likeness or naturalness. . . . What can the miniature painter–the painter of real portraits, not ideal or poetic images–do against the Sun?[57]

In 1853 Claudet was commanded to take stereo portraits of Queen Victoria and other members of the royal family at Buckingham Palace, and this led to his appointment as 'Photographer-in-Ordinary to the Queen'.

Claudet prided himself on being not only the first to practise the daguerreotype in England but also the last to abandon the process. In the 1850s he specialized in stereoscopic daguerreotypes.[58] Like other high-class photographers he did not practice ambrotype portraiture, but he at once accepted the carte de visite when the rising star J. E. Mayall set the fashion for them in England in 1860. Claudet's importance, however, lies not only in the field of photographic portraiture. His scientific attainments and his inventive genius were of a very high order. Indeed, few people are so closely identified with the progress of photography in its first three decades. There was not a single year between 1841 and his death in 1868 in which Claudet did not bring some valuable practical or scientific contribution to photography to the notice of the British Association, the Royal Society (which elected him a Fellow in 1853), or some other scientific or photographic body, in Britain or in France. The most important of Claudet's inventions and improvements are mentioned in the relevant chapters. Others may be briefly referred to here. The photographometer (1848) measured the intensity of light, and is the earliest light meter in photography. The focimeter (1849) enabled the photographer to ascertain the chemical focus which in achromatic lenses did not coincide with the visual focus. With the dynactinometer (1850) the rapidity of different lenses could be compared. An admirable characteristic was the way in which he propogated other people's inventions with the same enthusiasm as if they had been his own.

OTHER DAGUERREOTYPISTS IN LONDON

Though Beard sold licences for the provinces almost immediately after becoming sole patentee, he did not relax his tight hold on his monopoly in the capital–apart from Claudet, of course–until June 1846. His change of mind may be due to the protracted lawsuit against Egerton, so that he did not wish to invest in new studios, although the demand for daguerreotype portraits continued to increase. Three new daguerreotypists, all licensed by Beard, opened studios in London during the latter part of 1846 and 1847. First on the scene was an American, J. E. Mayall, followed by A. L. Cocke and W. E. Kilburn.

JOHN JABEZ EDWIN MAYALL arrived in London towards the end of 1846 from Philadelphia, where he had originally been a lecturer in chemistry and had run a daguerreotype studio since 1842. For a couple of months or so he seems to have managed Claudet's business at King William Street, Strand, while the latter was establishing his new studio at the Colosseum, but by April 1847 Mayall had made himself independent at his American Daguerreotype Institution, 433 West Strand, where he operated for a while under the pseudonym of 'Professor Highschool'–the name he had used in Philadelphia. Mayall at once did a flourishing business, for, like all American daguerreotypes, his had a greatly superior polish and clarity, and were larger than English ones. A 'life-size' portrait shown in the photographic section of the Birmingham Exhibition of Manufactures and Art, 1849, was described as 'the largest picture which the pure pencil of the sunbeam has ever painted'.[59] Another photograph claimed to be the 'largest-ever' daguerreotype was a 'Bacchus and Ariadne' (possibly a copy of a painting) measuring 24 in × 15 in.–a great technical feat.

While still in Philadelphia Mayall had produced in 1845 a series of ten daguerreotypes illustrating the Lord's Prayer:

> These are the first efforts in developing the new branch of *photographic fine art*. . . . Female figures (some of the most beautiful and talented ladies of Philadelphia) have been chosen to embody the precepts of this Divine Prayer. 'Our Father Which Art in Heaven'–the illustration is a Lady on her knees before the Altar, her eyes directed to the Catholic emblem of the Redeemer, the Saviour on the Cross; the pure expression of humility and penitence in the countenance and attitude, finely embodies the opening sentiment of the prayer. . . . 'Give us this Day our Daily Bread'–a way-worn Pilgrim, with staff in hand, weary with fatigue, is receiving two loaves from the hands of a beautiful child.[60]

In 1848 Mayall composed a set of six daguerreotypes to illustrate Campbell's poem 'The Soldier's Dream'. These compositions, together with 'The Venerable Bede Blessing an Anglo-Saxon Child', were described in the catalogue of the Great Exhibition, 1851, as 'Daguerreotype pictures to illustrate poetry and sentiment'. In some, the landscape or background was painted in with a fine brush; in others, the sitters had been posed in front of painted scenery 'to make the whole harmonize together'. *The Athenaeum* was full of praise for Mayall's portrait work, placing him with Claudet and Kilburn in the front rank, but cautioned its readers concerning Mayall's assertion that the daguerreotype was capable of illustrating history. 'It seems to us a mistake. At best, we can only hope to get a mere naturalistic rendering. Ideality is unattainable–and imagination supplanted by the presence of fact.'[61]

Mayall probably recognized the validity of this criticism, for though he was the first in the field of so-called 'art photography' he did not continue making composition daguerreotypes, in spite of the fact that they aroused much admiration at the Great Exhibition. 'The Prince Consort was especially kind and took him by the hand, consulting him now and again upon the rapid strides which photography began to take.'

Another novelty introduced by Mayall at the Great Exhibition was 'crayon daguerreotypes'–better known as vignetted portraits. Invented by J. A. Whipple of Boston and patented by M. A. Root of Philadelphia in 1849, vignetting enjoyed considerable popularity in fashionable studios for many decades. In January 1853 Mayall was granted a patent for an improved method: between the sitter and the camera was placed a revolving disk run by clockwork, with an aperture in the form of a star; the effect was a portrait in which the head was sharp, the remainder gradually fading into the background.

Mayall took daguerreotypes of many celebrities, including Daguerre, Herschel, Faraday, Brewster, and Bulwer Lytton (all between 1846 and 1848). Pl 28

Portrait photography, then as now, was a tricky business, demanding great patience and tact on the part of the photographer. Vanity is manifest to every portraitist, whether painter or photographer. Most sitters expect a flattering version of themselves and invariably consider themselves better looking than they are. Mayall had his share of difficult sitters, but not all were as obstinate as a fastidious lady who had sat for her portrait in his absence.

> In turn every possible view of the face had been tried: right-side, and left-side, front, three-quarters, and profile, and almost every modification between; but the lady was dissatisfied. . . . Presenting herself next morning, and explaining the case, she was blandly received by Mr. M., who had heard all particulars from his operator.
>
> 'Be so good as to take a seat here, madam', placing a chair with its back to the camera.
>
> The lady, wondering, did as she was desired; Mr M. then proceeded gravely to place the head-rest to the forehead instead of as usual to the back of the head. Having focussed, and put the plate in the camera, he said,
>
> 'Now, madam, if you will be so good as to remain quite still for a few moments–'
>
> 'Why, Mr M., you are about to take the back of my head!' exclaimed the lady.
>
> 'Precisely so, madam. That is the only change now left for us. I have seen the pictures taken, they are all excellent Daguerreotypes, and very good likenesses. Every possible view of the face has been tried; our only chance of pleasing now, is by trying a portrait in which the face will be entirely absent.'
>
> The artist was polite and good tempered, and the lady, not entirely unreasonable, was struck with the ludicrous position: with a laugh she asked permission to see the rejected pictures of yesterday once more, and eventually selected several of them to be finished and paid for.[62]

About 1852 Mayall opened a second studio, at 224 Regent Street (Argyll Place), under the management of a Dr Bushnell, also formerly of Philadelphia; and in June 1855 Mayall sold his American Daguerreotype Institution in the Strand to Jabez Hughes.

WILLIAM EDWARD KILBURN appears to have opened his daguerreotype studio at 234 Regent Street some time in 1846. Kilburn's 'photographic miniatures' were advertised as 'an important improvement upon daguerreotype portraits', but the 'improvement' was actually a retrograde step, for 'the likeness taken by the photographic process serves merely as a sketch for the miniature, which is painted by M. Mansion. . . . They have, when finished, all the delicacy of an elaborate miniature with the infallible accuracy of expression only obtained by the photographic process.[63] M. Mansion was at that time working for all the leading daguerreotypists in London. High-class miniature painters found a new lease of life by deftly combining the old art with the new.

The top of Swan & Edgar's old premises in Regent Street has sometimes been mistakenly regarded as the site of the first public photographic studio in London.[64] ARCHIBALD LEWIS COCKE had his first daguerreotype studio 'on top of an elegant draper's shop' at 44 Regent Street, at the southern end of the Quadrant, but he did not open his studio until the spring or summer of 1847. Later, he moved to 179 Regent Street.

WILLIAM TELFER'S Royal Photographic Establishment at 194 Regent Street, which Pl 58 was opened about 1848, produced some exquisite daguerreotypes. A year or two later T. R. WILLIAMS, who had started as assistant to Claudet at the Adelaide Gallery and then entered Beard's employment, established his own business at 236 Regent Street.

These were all the fashionable daguerreotypists in London, but by far the larger Pl 59 number of daguerreotype portraits bear no sign of origin, which indicates that not a few traded 'black' outside the West End, and possibly even within. The Fleet Street region seems to have been favoured for such operations. It was here that Egerton worked until served with an injunction by Beard. There was also a Miss Wigley of 108 Fleet Street, the first woman professional photographer in Britain; and another daguerreotypist whose establishment appears in loftier regions in 'Cuthbert Bede's' amusing account than it probably was in reality:

> A placard informed us, that the Daguerreotype and Photographic Rooms were upstairs☞. So we passed down a dark passage, and tumbled on to a still darker staircase, to the great damage of our shins, and the needless outlay of inelegant expressions. With a little difficulty, we got up a flight of steep stairs, kicking against each stair as we went, to keep ourselves in the right track; and, at length we found ourselves on a small landing, of a size calculated to hold one uncomfortably. We looked about us, and, by the light that dimly straggled through a half-glass door, we saw before our nose,–indeed, against it,–another ☞ as though pointing out to us an upward path. We silently took it; the way was steep and sterile–for the carpeting had ceased at the first *plateau*,–and we began to feel fatigued. We arrived at another landing, as shrunken in its dimensions as the previous one; and there, on the wall, gleamed the mystic☞. Gloomy thoughts took possession of our mind; but the faint sound of 'Cheer, boys, cheer!' played on an organ in the street below, encouraged us to proceed. We staggered up another steep and sterile flight, and, by a toilsome route, gained another *plateau*. Still, the mystic ☞ was there, and still it urged us upwards–upwards!
>
> We went on. The air from the organ in the street below became fainter, and fainter; the air from the attics and the rooms above grew denser and denser. We staggered, and would have fallen; but we recovered ourselves by a strong effort, and pushed on. We reached another small landing, but the ☞ was there before us . . . and we continued the ascent. Again the light beamed upon us from a staircase window, but it served only to reveal the hazardous nature of our expedition. Shall we forego the enterprise, and descend? No! the courage of an English heart forbids it, so long as there is a chance of success. We go on. Another landing, and another☞. Is it a demon hand that is going before us, and luring us on to destruction? ? Horrible fancies fill our brain. A door is beside us, the handle towards our hand: Come, let us clutch it! and it opens. What do we see? A bald-headed woman in a semi-dressed state, who rushes behind some bed-curtains, and screams 'It's upstairs! It's upstairs!' What is upstairs? let us go and see. We apologise to the bald-headed female, and go upstairs. . . . Another landing is gained; and still the demon ☞is urging us upwards. We faintly sing the National Anthem (with our hat off) and, after the third verse, feel sufficiently invigorated to pursue our upward path. A few more moments of toil, and our exertions are crowned with success; we sink down exhausted at the door of the Daguerreotype Room. No need now for the demon☞to point out what we have discovered. Ha! ha! We have discovered that Fig 15 Photography is, indeed, High Art.[65]

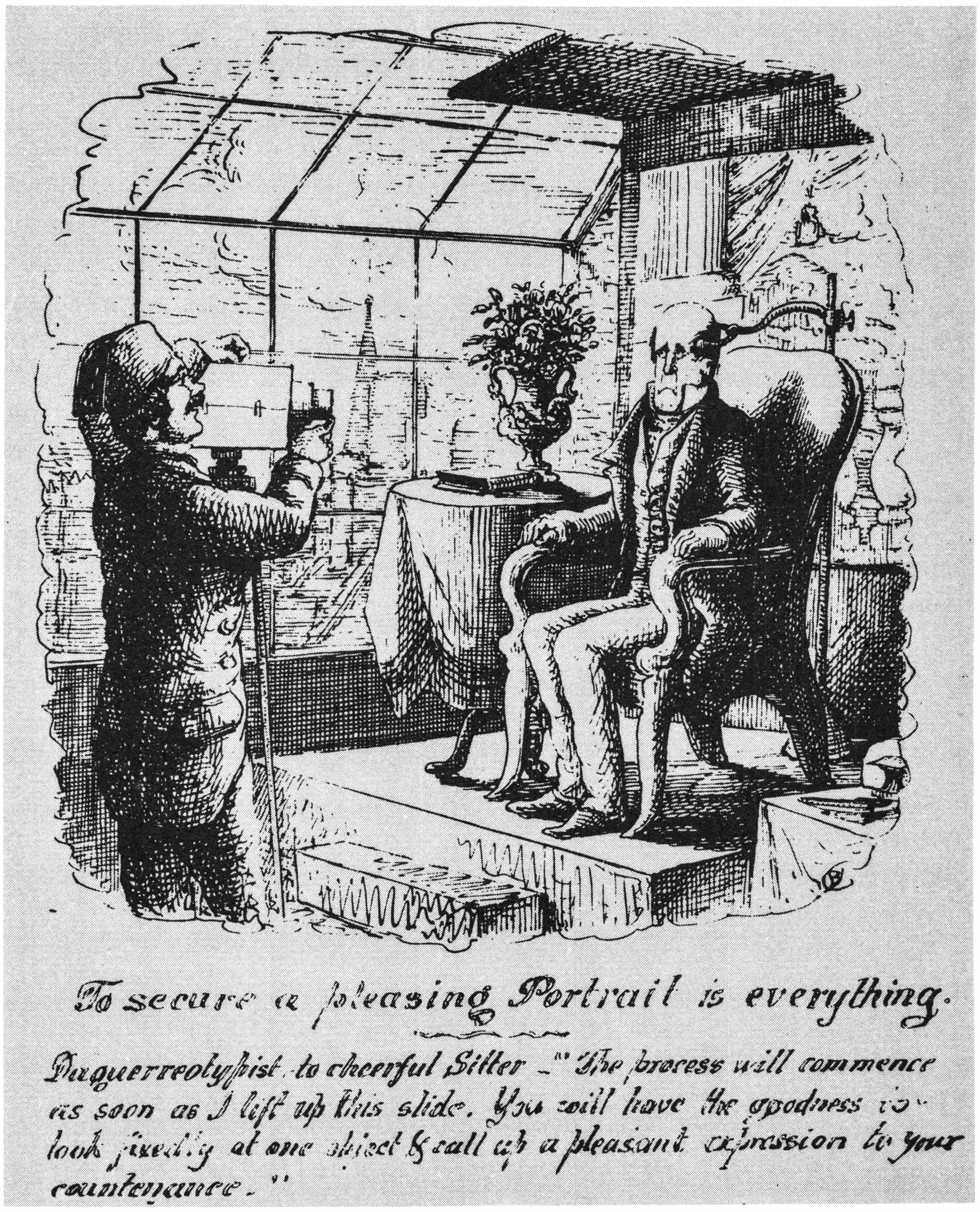

To secure a pleasing Portrait is everything.
Daguerreotypist to cheerful Sitter — "The process will commence as soon as I lift up this slide. You will have the goodness to look fixedly at one object & call up a pleasant expression to your countenance."

Fig 15 'Cuthbert Bede'. Caricature of a daguerreotypist at work, 1855

THE DAGUERREOTYPE OUTSIDE LONDON

An optician and well-known microscopist, JOHN BENJAMIN DANCER, took daguerreotypes of the public buildings of LIVERPOOL in 1840 with a camera of his own construction, and demonstrated the process to an audience of 1,500 people at the Liverpool Mechanics' Institution in July 1840. The main attraction was a daguerreotype of a flea magnified, by means of a gas microscope, large enough to fill a 7 in. × 5 in. plate. Beard's studio at 34 Church Street opened late in 1842 or in 1843 under the management of James F. Foard, who took over the business after Beard's bankruptcy in 1850.

In 1841 Dancer moved to MANCHESTER, where, as in Liverpool, he was the first to introduce the daguerreotype–prior to the opening of Beard's daguerreotype portrait gallery in November over the Manchester Exchange, the licensee being JOHN JOHNSON. Though Dancer did not carry on the process professionally, his optical business benefited from the sale of apparatus and chemicals.[66]

GEORGE SHAW is said to have opened the first photographic studio in BIRMINGHAM late in 1841 or in 1842. He was for many years a prominent photographer in that city.

H. J. WHITLOCK senior was the sole licensee for the daguerreotype throughout Warwickshire, and opened a studio in Birmingham about 1842. It is possible that at first Shaw and Whitlock worked together.

R. LOWE established a daguerreotype studio in the Promenade, CHELTENHAM, about 1845; H. C. BOOTH at Prospect Place, LOW HARROGATE, in July 1847, from which address he moved to Royal Parade, Low Harrogate, exactly two years later. At the same time a MR HOLROYD opened a gallery at York Place, High Harrogate, while his brother started a studio at SCARBOROUGH about the same date. In YORK was the studio of WILLIAM PUMPHREY, later well known for his waxed-paper photographs, and in WHITBY a daguerreotypist named STONEHOUSE.

THOMAS SIMS opened a daguerreotype studio at WESTON-SUPER-MARE in 1847 under licence from Thomas Sharp, who had bought the sole rights for the county of Somerset from the patentee.

The well-known optician THOMAS DAVIDSON of EDINBURGH was the first to experiment with the daguerreotype in SCOTLAND. On 23 November 1840 he communicated to the Royal Scottish Society of Arts a paper entitled 'Description of the Process of Daguerreotype, and Remarks on the Action of Light in that Process, both in respect to Landscape and Miniature Portraits'.

Davidson occupied himself mainly with improving the optics of the camera, and during the second half of 1841 succeeded in making a good double combination portrait lens which was in design similar to, though not as fast as, the Petzval lens. In the following year he constructed a metal daguerreotype camera which was in many respects an improvement on Voigtländer's, and, like his portrait lens, may have been an independent invention.

An example of this apparatus was discovered by the author in July 1952 at the Royal Scottish Museum, Edinburgh, where its unusual shape had prevented its Pl 61 recognition as a camera. Neither camera nor lens bears any manufacturer's name or sign of origin, but there seems little doubt that his camera was made by Davidson. The brass tube is 9 in. long and 4⅛ in. in diameter, and is fitted with a plano-convex and plano-concave lens combination with built-in stop, and a rack and pinion for focusing. Inside the tube is a focusing-glass 2¾ in. square. The brass plate-holder (on the left of the picture) containing the silvered copper plate is pushed into a groove in front of the ground-glass. The brass cap (on the right of the picture) is then put on to the back of the camera to make it light-tight. By turning a knob underneath the tube 180°, the ground-glass plus plate-holder is turned towards the lens, and by an ingenious arrangement of a projection inside the tube pressing against the edge of the plate-holder, this is opened like a book, thus exposing the plate. After the exposure, by turning the knob on the outside back again, the projection closes the plate-holder. The camera back is then taken off, the plate-holder taken out, and a new one inserted. In this point the camera represents an improvement on Voigtländer's, which had to be taken to the darkroom for plate-changing. Moreover, the swivelling device of the brass stand enabled it to be turned up or down, while Voigtländer's had to be absolutely level with the sitter.

The first professional daguerreotypist in Edinburgh was a man named HOWIE, who began operating on the roof of a house in Princes Street late in 1841 with Davidson's improved lens.

> Mr Howie's arrangements were at first of the simplest kind. His sitters had to climb three flights of stairs, and then by a kind of ladder reached a skylight, through which they got access to the roof of the house. The posing chair, with something

> in the shape of a head-rest fixed to its back, was placed against the gable of the adjoining building, and the operator used to take the sitter by the shoulders and press him down with the observation–'There! now sit as still as death!' Of course, under such circumstances, with the sun shining brilliantly and the exposure counted by minutes, artistic portraiture was not to be expected; but Mr Howie did very well, notwithstanding, and gathered about him large numbers of those interested in the new art from all parts of the country.[67]

Howie and Davidson were intimate friends, and on one occasion they went, in company with Sir David Brewster, Mr Cosmo Innes, and Captain Scott, to East Princes Gardens to test a new lens, while a typical Edinburgh wind was blowing. Captain Scott was posed, and his hat, by way of aiding the composition, was placed on the ground at his side.

> The tripod being somewhat rickety, a long window sash-weight was laid across the camera to keep it steady. Mr Davidson–whose temper had been sorely tried both by the wind and the desire of the sitter to move at inconvenient times–was the operator, and just at the critical moment the Captain cried, 'Oh, stop! the wind is moving my hat!' whereupon Mr Davidson seized the sash-weight and pitched it into the hat, through the crown of which it went, sinking several inches into the ground, and exclaimed, 'There! No fear of movement now!'[68]

Apart from Howie, we hear of two other early professional daguerreotype studios in Edinburgh: ROSS AND THOMPSON, a firm later noted for their albumen-on-glass pictures, and that of a MR POPPAWITZ.

In GLASGOW the first professional photographer was a MR EDWARDS, who opened a blue glass studio in Buchanan Street opposite the Arcade in 1842. In the same year another daguerreotypist named TREFFRAY started at the corner of Union and Argyle Streets; then came PICKERING, and in 1846 BERNARD commenced business. The latter's pictures were particularly good, and portraiture in Glasgow is said to have made a rapid advance with him. The next daguerreotypists heard of in Glasgow are BORTHWICK and STANLEY, and C. JABEZ HUGHES, who had entered the profession as Mayall's assistant in London in 1847, subsequently became Bernard's assistant, succeeding to his business in 1849,[69] and to Mayall's studio in the Strand, London, in 1855.

In IRELAND the first Daguerreotype Portrait Institution was opened in 1842 by 'PROFESSOR' GLÜCKMAN at 13 Lower Sackville Street, Dublin. Newspapers often referred to daguerreotypists as 'professors'; a few adopted the title.

As photography was patent-free in Scotland and Ireland, daguerreotypists there not infrequently made short but profitable incursions into England. An itinerant Irish daguerreotypist named MCGHEE is supposed to have toured the north of England with his photographic wagon for a considerable time without being noticed by the patentee.

Cost of daguerreotype outfits

In Britain in the late 1840s a complete daguerreotype outfit with a double combination achromatic lens could be bought for between eight guineas (for plates 3¼ in. × 4¼ in.) and £26 (for plates 6½ in. × 8½ in.).

The prices of chemicals used in the daguerreotype process were in 1843: bromide of iodine, and chloride of iodine, 4*s.* 6*d.* per oz.; mercury, 5*s.* per lb.; chloride of gold solution, 5*s.* per oz.; hyposulphite of soda, 8*s.* per lb.

The price of daguerreotype plates depended on the thickness of the silver coating:

Best quality plate *size in inches*	*Cost in 1843* *per dozen*		
2 × 2½		15	0
3¼ × 4¼	£1	10	0
4¾ × 6½	£3	0	0
6½ × 8½	£5	5	0

By 1851 the price had fallen to about one-half.

13 The daguerreotype in German-speaking countries

Immediately after the publication of the daguerreotype Giroux despatched six outfits, with instruction manuals, to LOUIS SACHSE, art-dealer and proprietor of a lithographic establishment in Berlin. These had been on order since July, for Sachse, who was in Paris on business in April 1839, had arranged with Daguerre personally that he should be the first person in Germany to receive the apparatus. Each outfit cost 425 francs and the freight charges on the consignment amounted to 600 francs (equivalent to £126 altogether). To Sachse's horror and indignation, the cases which were delivered on 6 September had been badly packed and considerable damage done to the contents. Many days' repair work was necessary before he could despatch five of the outfits to his customers. With the sixth, Sachse started daguerreotyping himself. His ambition to be the first person in Germany to receive daguerreotype apparatus had come true, but Giroux's negligence had deprived him of the initial advantage. Full reports of the manipulation appeared in the *Vossische Zeitung* and other papers on 26 August, and on 15 September Sachse had the mortification of seeing a locally-made apparatus exhibited at the premises of the optician THEODOR DÖRFFEL in Unter den Linden at the low cost of 25 Thalers (75 Marks) – without lens. Some half-plate and one-sixth plate daguerreotypes by Dörffel were on view at the same time: others by him – views of the New Museum, the Armoury, and some statues – were shown in the gallery of Georg Gropius at the Bauschule. Although their general effect was not considered artistic, they were the first daguerreotypes to be seen in Berlin – probably in Germany.

It was not until five days later that Sachse was able to display at his shop a daguerreotype which he had taken himself, and one by Mme Giroux which had been sent with the apparatus. It was the first to reach Germany, and represented a picturesque arrangement of statues, sculptured columns, and drapery. Mme Giroux took many of the specimen pictures which were sold with the apparatus, and deserves remembrance as the first woman photographer. Sachse's subject was a view of the Jägerstrasse with one of the Gendarme-towers, and was considered a perfect picture, not merely a scientific experiment – implying that Dörffel's were inferior.

'What a wonderful, heavenly invention Daguerre has made!' enthused Sachse to a customer in Königsberg. 'I tell you, one could lose one's senses when one sees such a picture, made to a certain extent by Nature alone.' Making daguerreotypes was indeed a heavenly gift – Sachse made them as fast as he could at 1–2 *Friedrich d'or* (17*s.* 6*d.* to 35*s.*) apiece, for the demand outstripped the supply. He claimed to have taken and sold over 600 quarter-plate pictures in the first six weeks, and imported French daguerreotypes, mostly by Giroux and his wife, found eager purchasers at

60–120 francs. On 30 September Sachse was summoned to Charlottenburg, where he took five views in the presence of King Frederick William III of Prussia.

One of the people to whom Sachse sold a daguerreotype outfit at the end of September 1839 for the equivalent of 600 francs was the Schwerin painter FRIEDRICH SCHNELLE who, together with the sculptor CHRISTOPH HEINRICH HERMANN PETTERS, hoped to find in the new invention a better livelihood than by their art. From 24 October on they offered for sale at a bookshop a number of their whole-plate and quarter-plate views of Schwerin, capital of Mecklenburg. Despite the high praise lavished on them, the demand for these local views was too small to justify the expense, and the photographic activities of Schnelle and Petters came to an end.[1]

About 20 September EDUARD PETITPIERRE, a Swiss who had settled in Berlin and had been appointed optician to the king, also received a Giroux outfit. One of his first daguerreotypes, a view in the Lustgarten, aroused some amusement because it revealed a loving couple who had been gazing at each other entranced so that they appeared quite distinctly on the plate although the exposure had lasted 23 minutes! In another view the guard at the Museum appeared in the picture twice, having changed his position during the exposure. In appreciation of three daguerreotypes which the enterprising photographer sent to Tsar Nicholas I soon afterwards, he was rewarded with a diamond ring.

Petitpierre intended to use his Giroux outfit as a model for the construction of others, which he announced would cost only about half the French price (18 *Fr. d'or*= 306 Marks). But neither he nor Dörffel, who had taken orders for cheap cameras of his own design, was able to produce any within the first two months because suitable achromatic lenses were difficult to obtain in Germany. In the end, Dörffel was obliged to grind his own.

The only person in Berlin who could make silvered copper plates[2] was the Court goldsmith, J. G. Hossauer, who had also taken up photography.

These early Berlin daguerreotypists used to meet at the newly founded Polytechnic Society for the exchange of 'tips' and discussions.

The keen interest of the Germans in the daguerreotype is evinced by the surprisingly large number of ten publications which appeared within the first two months in Berlin, Stuttgart, Karlsruhe, Hamburg, Halle and Leipzig. In fact more brochures appeared in Germany than in any other country, though some of the earlier ones were mere compilations or translations of Donné's report in the *Journal des Débats*. Two manuals purporting to give instructions on Daguerre's process had even appeared before it was revealed and were largely speculative.[3]

After reading a short description of Daguerre's method in the *Bayrische Nationalzeitung* on 24 August, Carl August von Steinheil made two daguerreotypes which were highly praised when exhibited at the Munich Kunstverein on 4 September. Daguerre's instruction manual was reprinted complete with plates in the September/October double issue of the *Kunst- und Gewerbeblatt* in Munich, and Steinheil from now on devoted his interest to the daguerreotype process which he obviously found preferable to the paper process (see page 94). He constructed a miniature camera[4] for 8 mm. × 11 mm. plates, with a fixed-focus lens of 25 mm. focal length, rendering both near and distant objects sharp at the same time. The comparatively large lens opening (F.2·5) allowed of taking pictures even on dull rainy days, but the tiny pictures had to be viewed through a magnifying-glass, and this drawback made the practical introduction of the apparatus impossible. Steinheil's miniature camera was one of the many inventions that came before its time. This first miniature camera–which was much smaller than Talbot's 'mousetraps' of 1835–is no longer in existence.

The first portrait in Germany was taken by Sachse in April 1840: little was said about it beyond the fact that 'the sitter is as easily recognizable as in a freehand drawing'.[5] Portraiture, in fact, made no progress in Germany until well after the introduction of the portrait lens designed by PROFESSOR JOSEF MAX PETZVAL of Vienna. The idea of calculating a lens specially for portraiture had been suggested to the mathematician by his friend Professor A. von Ettinghausen, who happened to be in Paris at the time of the publication of the daguerreotype. Ettinghausen was as enthusiastic for the new invention as he was critical of the slow lenses with which Daguerre's cameras were fitted. He had several discussions on the subject with Chevalier, and during one of his visits was shown the latter's double combination achromatic lens for the telescope. Whether or not this lens gave Ettinghausen the idea that a similar lens would be advantageous for photographic purposes–as Chevalier later claimed–is difficult to establish. It is, however, certain that Petzval used a well-corrected telescope lens for his front component, adding an air-spaced doublet behind it, which was mathematically designed to give sharp definition and to correct spherical aberration. Petzval's double combination lens was characterized by a large aperture (F.3·6), fairly short focal length (15 cm.), and gave excellent definition in the picture centre without the use of a stop. It could therefore be employed for portraiture at its full aperture, which made it twenty times faster than the Chevalier and Lerebours lenses in the original Daguerre cameras. At Petzval's request Anton Martin of the Polytechnic Institute in Vienna made some experimental portraits in May 1840, and after further modifications the lens was put into production by the old-established Viennese opticians Voigtländer & Sohn, and put on the market in November. To enhance its efficiency Voigtländer introduced on 1 January 1841 a conical-shaped camera specially designed for it, and taking small circular pictures 9 cm. (3½ in.) in diameter. After the sitter had been focused through the magnifying-glass which was fixed behind the ground-glass, the camera had to be removed from its stand and taken to the darkroom, where its whole rear portion was unscrewed and replaced by a sensitized plate in a circular holder. This unpractical arrangement was a drawback to the otherwise ingenious design (a fault avoided in the similar camera of the Edinburgh optician Davidson) and for this reason, perhaps, only seventy cameras were sold during 1841, at a price of 95 or 120 Austrian gulden (1 gulden=about 2*s*.) according to whether they were made of wood or brass. Only the conical-shaped camera was made of brass. The walnut camera was of the usual box shape for plates 2⅔ in. × 3 in. or 3 in. × 4 in. In the spring of 1842 Voigtländer introduced cameras for pictures up to 5½ in. in diameter at a price of 144 gulden, the lens having a focal length of 12 in. and an opening of 3 in. In each case the price included the complete outfit for the daguerreotype process. Pl 60

The Petzval-Voigtländer lens, which was soon produced in various focal lengths, quickly established itself as the *sine qua non* for portraiture, and was exported all over the world. Best proof of its excellence were the many 'Petzval type' imitations made in every country, and sold in France as 'système allemand'. In 1862 Voigtländer made the 10,000th lens, and throughout the nineteenth century it remained the most widely used portrait lens in every country. With it, the ascendancy of the German photographic optical industry may be said to have begun.

According to Voigtländer's instruction booklet[6] exposures in the open air were 'on a dark day in winter 3½ minutes, on a sunny day in the shade 1½ to 2 minutes, in direct sunshine 40 to 45 seconds'. In other words, exposure and picture size were comparable to Draper's in New York the previous summer. Soon after publication of the brochure the daguerreotype was speeded up by chemical means, and in an addendum dated 1 August 1841 the manufacturers stated that 4 to 15 seconds in the shade, or one second in sunshine, was now sufficient.

The chemical acceleration referred to was due to the Viennese civil servant FRANZ KRATOCHWILA, who found that by exposing the iodized plate to the combined vapours of chlorine and bromine its sensitivity was increased five times. Kratochwila published[7] his process on 19 January 1841, five weeks after J. F. Goddard's publication in London of bromine as an accelerator. At the beginning of March the brothers JOHANN and JOSEPH NATTERER, Viennese students, were reported[8] to have taken portraits with the Voigtländer camera on plates subjected to the action of iodine and chlorine vapour in 5 to 6 seconds in clear weather, and 10 seconds in dull weather reinforced with ordinary lamp-light. According to Professor Berres[9] the Natterer brothers must also be credited with having taken the first instantaneous street views depicting people and traffic in motion. Thus chemical acceleration and the Petzval lens combined, reduced exposures to a second–the time it took to remove and replace the lens cap.

About this time was formed the Freie Vereinigung von Freunden der Daguerreotypie, an informal association of about a dozen amateur daguerreotypists who met from time to time at the Fürstenhof on the Landstrasse, Vienna, bringing the results of their experiments for discussion.[10] The leading spirits of the group were the Professors von Ettinghausen, Petzval and Berres, others being Voigtländer, the Natterer brothers, Kratochwila, Anton Martin, Librarian at the Polytechnic Institute, who later wrote several photographic handbooks, Regierungsrat Schultner, a civil servant, Dr Joseph Johann Pohl, the apothecary Endlicher, and the photographers CARL REISER and KARL SCHUH. The latter, a Berliner, is said to have been the first professional portrait photographer in Vienna, with a studio at the Fürstenhof. The exact date is not known beyond the fact that it was in 1841. In October 1841 Reiser daguerreotyped several members of the Bavarian royal family in Munich, and for a short time members of the public in a glass-house put at his disposal in the botanical gardens. Some daguerreotypes which he exhibited at the Art Society were considered better than any hitherto seen in Munich.[11]

The first Petzval-Voigtländer apparatus was imported into Berlin by Sachse on 6 October 1841, and during that month JOSEPH WAWRA, a Viennese painter, availing himself of the latest improvements took–for a few weeks–the first really satisfactory and artistic portraits in Berlin.

Strangely enough it is not until August of the following year that we hear of the first professional portrait studio there. It was opened at 41 Zimmerstrasse by J. C. SCHALL, a portrait painter whose earliest traceable advertisement appeared on 16 August 1842. Within three weeks competition arose from the portrait painter JULIUS STIBA who originally taught 'quick painting' on paper, wood, glass and porcelain in six lessons (success guaranteed) at 64 Friedrichstrasse. For a while Stiba included daguerreotype in his art courses, but when he found photographic portraiture more profitable he abandoned teaching altogether.

Schall's and Stiba's studios were very primitive. Their sitters were posed in the open courtyard, a sheet serving as background. The exposure was usually a minute in fine weather. After two o'clock operations stopped and on dull days the 'studio' was closed.

With the approaching Christmas season more artists turned photographer, attracted by the prospect of lively business. As the weather became colder they were driven indoors, but from 17 December on Schall was able to invite clients to his heated glass-house–the first of its kind in Berlin. Berliners had apparently also their share of 'black portraits' due to under-exposure, and Schall's announcement may not have seemed so quaint then as it does now: 'I will refrain from praising my own pictures, which are sufficiently known to my valued clients for their good likenesses, strong effect, and sharpness. I will only permit myself to remark that my portraits are not like Moors, as is usually the case with those taken indoors, but are clear and white, that is to say, truly European.'[12] In April 1843 Schall added another attraction – colouring daguerreotypes, which he had patented.

The most artistic daguerreotype portraits in Germany, and some of the finest in the world, were taken by two Hamburg photographers, the artists HERMANN BIOW and CARL FERDINAND STELZNER.

Biow's 'heliographic studio' at 163 Königstrasse, Altona, opened on 15 September 1841, preceded any in Berlin, if not in Germany. The following summer he installed himself temporarily in the Belvedere of the Baumhaus, Hamburg, and from the beginning of September 1842 on, he and Stelzner collaborated for seven months in a specially built glass-house at 32 Caffamacherreihe. After this, Biow set up an independent studio again at 52 Neuerwall, where he introduced hand-coloured daguerreotypes.

It is an ironic circumstance that the earliest news photographs were taken at the very moment when the world's first illustrated paper, *The Illustrated London News*, was going to press with its first issue – yet neither the photographers nor the proprietors of the paper knew of the existence of the other. Biow and Stelzner took a large number of daguerreotypes of the ruins of the Alster district of Hamburg after a terrible conflagration on 5–8 May 1842. Unaware of these authentic pictures, the proprietors of *The Illustrated London News* published instead an imaginary view of the fire, based on an old print of Hamburg in the British Museum, on the front page of its first issue on 14 May. Biow recorded the devastation in a series of forty daguerreotypes which he offered to the Hamburg Historical Society at his usual charge of 1 *Friedrich d'or* (17*s*. 6*d*.) each, but the Society, perhaps afraid of buying 'vanishing pictures', did not avail themselves of this opportunity, and so these irreplaceable historical documents were lost to posterity. Today only one by Stelzner remains in existence. Pl 63

In July 1843 the whole of Hamburg was kept amused by a quarrel between Biow and the then famous satirist M. G. Saphir, who had sat to the photographer for several free portraits. When Biow sent a messenger inviting Saphir to call to select the one he liked best, the humorist became abusive because the pictures had not been delivered to him. In revenge, the photographer delivered the portraits cut up. It was a declaration of war which Saphir repaid with a vitriolic attack on the daguerreotypist. 'Cephir' then joined the battle with a counter-attack on Saphir, and 'The Daguerreotype War in Hamburg' was in full swing.[13]

Biow was never short of a reason for enticing clients to his studio. Even foggy November weather was turned to advantage: 'The cold foggy days to be expected now are even more favourable to the certain effect of the light than the clearest sunshine.'

Between 1846 and his early death in 1850 Biow was much away from Hamburg, daguerreotyping royalty and celebrities in Dresden, Berlin and Frankfurt, where the work of the Hamburg portraitist was preferred to local talent. In Berlin a studio was set up for him in the Rittersaal of the Schloss, where he daguerreotyped King Frederick William IV, princes, ministers, the court and all the famous men in art and science such as Alexander von Humboldt and the sculptors Christian Rauch and Schadow. Ambition now began to haunt Biow. He planned – like Brady in America

–a National Gallery of Photographic Portraits. For this reason he travelled to Frankfurt in 1848 to photograph Archduke Johann, who had been appointed Administrator of the Empire, and the members of the National Assembly. Pl 64 One hundred and twenty-six of these portraits were published in Frankfurt the following year as lithographs.[14]

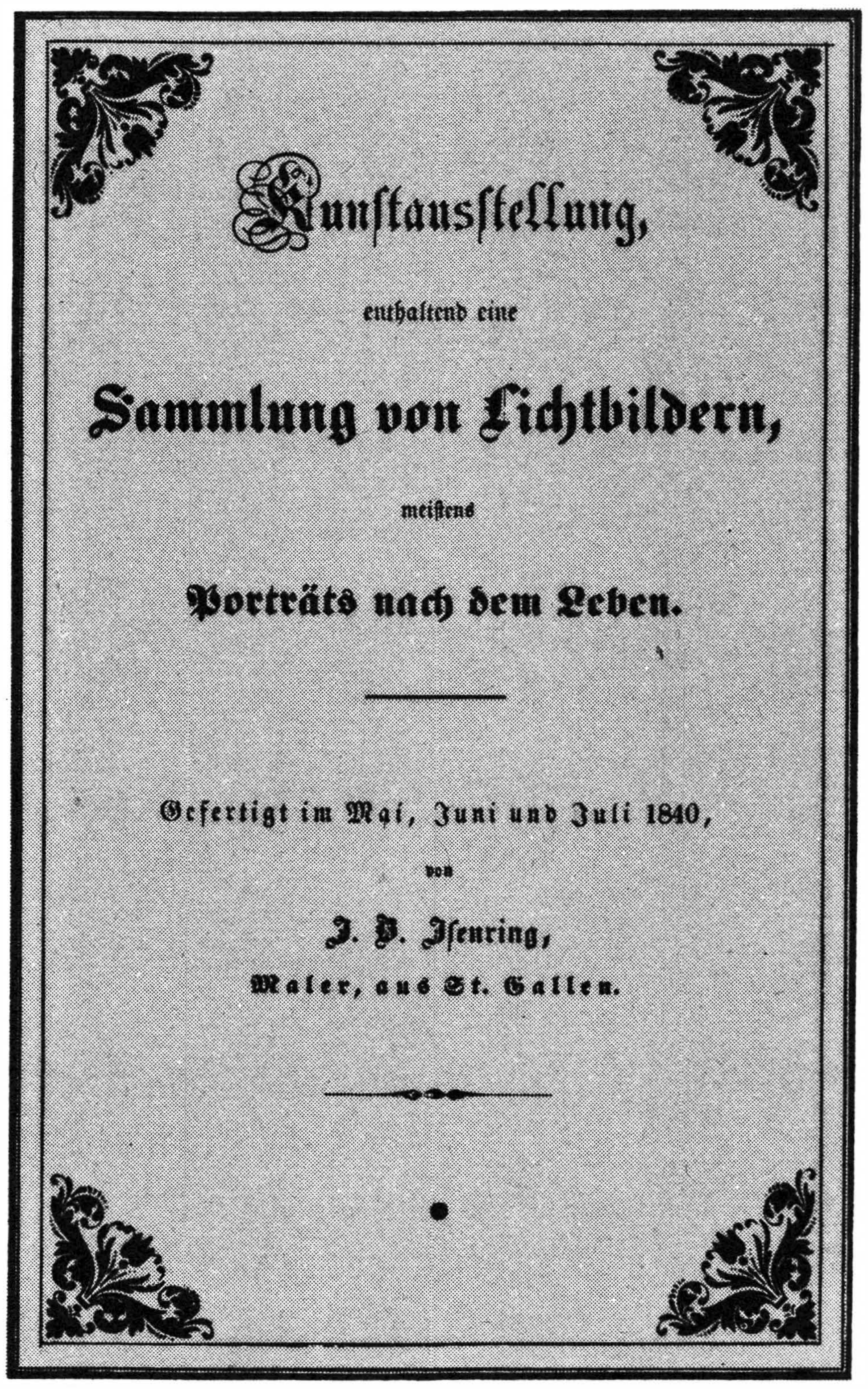
CARL FERDINAND STELZNER, who had studied under Isabey and other well-known artists in Paris, was originally a miniature painter. His photographs of the Hamburg fire and his first studio in partnership with Biow have already been mentioned. Stelzner's art training comes out unmistakably in his photographs. They are exquisite miniatures in photography and were frequently tinted by his wife, who as a Pl 65 professional miniature painter often used her husband's photographs to copy from. Stelzner's portraits cannot help impressing one by their high artistic quality. His skill in arranging a group of fifteen artists is quite remarkable. Pl 66

Many miniature painters turned to photography when their own art was ousted by the daguerreotype, and their portraits are still steeped in the traditions of the older art. Newcomers, on the other hand, brought a new outlook to photography, a freedom of pose and snapshot-like casualness which is truly photographic.

In Leipzig the first to take portraits professionally was JOSEPH WENINGER, an artist who came from Vienna and was active in Leipzig from January to May 1842, before going on to Copenhagen and Stockholm. In the summer of that year CARL DAUTHENDEY took portraits in Leipzig in his garden-house, before moving on to Dessau and St Petersburg where he became the first professional daguerreotypist in the autumn of 1843. The first permanent public studio in Leipzig was opened by the instrument-maker WEHNERT about August 1842.[15]

A special niche in the history of early daguerreotypists must be given to JOHANN BAPTIST ISENRING of St Gallen, Switzerland, a well-known copperplate engraver of topographical views. He ordered a daguerreotype outfit from Giroux in October 1839 and, undaunted by Arago's opinion, immediately set to work to solve the problem of portraiture. Finding it impossible to arrive at shorter exposures than about 20 minutes in full sunshine–particularly as he used plates up to 10 in. × 8 in.–Isenring over-painted the image and scratched in on the silvered plate the pupils of the eyes to correct the unsharpness caused by the sitter's blinking. Whatever the merit of these portraits may have been–and they were far from pure photography–Isenring deserves at least to be remembered as the first person to retouch photographs, and to attempt to give daguerreotypes a more lifelike appearance by colouring them with dry powders. Isenring also held the first public exhibition of portrait photographs in Europe. Fig 16 This was at his house in St Gallen in August 1840, and his four-page catalogue listing thirty-nine portraits, besides eight still-lifes, architecture, etc., was only preceded by Gouraud's in New York, December 1839.

Up to that time Isenring had only practised on relations and friends–the only victims willing to endure the long exposure–but after learning of Kratochwila's chemical acceleration he accepted orders from the public. In July 1841 he was in Munich, where for a short time he operated in a room in the Maximiliansplatz,[16] the exposure being one minute and the price of the portrait 2 Kronenthaler (1 Kr.T.= 4·60 Marks). At the Munich fair the same summer Isenring's portrait booth proved a great attraction: 'By the time you have said three paternosters–if you are still capable–your face is printed, however ugly it may be.' From a published aquatint of the Wittelsbacher Platz 'photographiert von J. B. Isenring in St Gallen' it is clear that he also daguerreotyped views in Munich, which served him as subjects for copperplate engravings.



Kunſtausſtellung,

enthaltend eine

Sammlung von Lichtbildern,

meiſtens

Porträts nach dem Leben.

Gefertigt im Mai, Juni und Juli 1840,

von

J. B. Iſenring,

Maler, aus St. Gallen.

Fig 16 Title-page of catalogue of the first exhibition of photographic portraits, August 1840

By April of the following year Isenring was the proud owner of a 'Sonnenwagen'– the earliest photographic carriage we know of, fitted up as living and sleeping quarters as well as studio and darkroom. This enabled him to extend his business activities as an itinerant daguerreotypist to southern Germany, Upper Austria and northern Switzerland. It was probably Isenring's daguerreotype portraits that Hans Andersen saw on a journey to southern Germany about 1841. They were the first daguerreotype portraits he had seen, 'made in ten minutes. . . . It seemed to me like magic. . . . The daguerreotype and the railway, these two new flowers of the present age, were to me already a benefit of the journey.'[17]

FRANZISKA MÖLLINGER of Solothurn travelled all over Switzerland taking views, fifteen of which she published copied as lithographs in 1844–45 under the title *Daguerreotypierte Ansichten der Hauptstädte und der schönsten Gegenden der Schweiz*.

About this time CARL DURHEIM, a lithographer in Berne, learned the daguerreotype process from a visiting Frenchman. In 1845 he opened a daguerreotype studio there, but in 1849 changed to the paper process–as did also J. B. Isenring.

In tracing the history of the daguerreotype in France, America, England, and German-speaking countries, we have concentrated on the nations which made important contributions both to the technique and aesthetics of the new art. To describe the introduction of the daguerreotype in other countries would be monotonous and add nothing essential to the understanding of its history and development. By 1842–43 all European capitals and large towns had one or more portrait studios, or at least were visited by itinerant photographers. With the exception of England and France, daguerreotype portraiture in Europe continued until about 1860. In these countries, the life of the daguerreotype was shorter on account of the advantages offered by the collodion process published by Frederick Scott Archer in 1851.

14 *The calotype and other paper processes in Great Britain, 1841–c.1857*

It may seem surprising that even Talbot's improved process, the calotype, which for speed brought photography on paper at least on a par with photography on metal, failed to establish itself for several years, until the fascination of the microscopical detail of the daguerreotype, which people loved to examine under a magnifying-glass, had worn off. On the Continent people were also influenced by the immense publicity surrounding Daguerre's invention, which was unhampered by patent restrictions, and the manipulatory details of which were available in cheap brochures.

In England the patent was the principal cause of the lack of popularity of the calotype, and the conditions which Fox Talbot imposed on licensees were not encouraging. W. RUSSELL SEDGFIELD, a landscape photographer, relates[1] that when he applied for an amateur licence in 1842, he was sent an agreement by Talbot's solicitors informing him that the fee was £20, that he was forbidden to give away any prints to friends without first obtaining Talbot's leave, that to sell any would lead to an injunction, and that if he should for any reason incur the displeasure of the patentee, the licence might be withdrawn at a moment's notice. Maybe there was no risk of incurring the patentee's displeasure if his instructions were conscientiously followed: the fact remains that few people cared to take up photography under such conditions.

Talbot's object in taking out a patent had been 'principally to establish definitely his claim to the invention',[2] but he also no doubt had in mind Sir David Brewster's opinion that there was no reason why a gentleman of independent means should scruple to derive profit from his own genius. The Talbot family was by no means as wealthy as people assumed, which is indicated by the fact that his mother had to let Lacock Abbey on her husband's death; and Lady Elisabeth was constantly reminding her son that his marvellous invention offered an opportunity to build up the family fortune again. Daguerre had been rewarded by the French Government with a life pension. In addition, he received a substantial income from royalties on the sale of apparatus, and £1,000 for his English patent. Moreover, Talbot saw a speculator, Richard Beard, amass a fortune out of the daguerreotype in England.

However, monetary gain was secondary to the honour and recognition which Talbot justifiably expected as an inventor. This point emerges again and again in the many lawsuits which he brought against infringers and alleged infringers of his patent, 'insisting upon claiming every form of photographic process howsoever unlike his own'.[3] Talbot's desire to enfore recognition was a psychological reaction;

had he been officially honoured by the Government as Daguerre was, he would probably have thrown open his process for everyone's pleasure and benefit. As it was, all he received was the Royal Society's Rumford Medal in 1842.

The only national reward that could have been offered to a person in Talbot's position would have been a title. Yet the country which had not considered it necessary to give a reward to James Watt for his great improvement upon the steam engine, or to George Stephenson, the originator of the railway system–both vital inventions for industrial expansion–was not likely to give a reward for an invention the main value of which–as far as could be envisaged at the time–lay 'only' in its artistic qualities. The arts and crafts in France had received liberal official support from the time of Louis XIV, and in England, apropos of Daguerre's pension, the question was asked with some indignation: 'When will the Government of Great Britain think it a part of duty to buy a grand discovery, and give it to the world? And if the Government were so inclined, when will the House of Commons entertain the proposition? The humbling fact stares us full in the face, that France has been, and we fear always will be, the leader in attempts to elevate the character of her people by a noble protection of the arts and sciences.'[4]

The first person to avail himself of Talbot's invention professionally was a miniature-painter, HENRY COLLEN, a regular exhibitor at the Royal Academy between 1820–72 and one of Queen Victoria's painting-masters.

Almost from the moment Daguerre's and Fox Talbot's inventions were made known, Henry Collen took an interest in the new art. In the spring and summer of 1840 he experimented with electrotyping daguerreotypes of engravings in the hope of improving this means of multiplication, but the impressions obtained were too indistinct to be of use.[5] After the calotype process had been published, nothing seemed to stand in the way of its application to portraiture but the acquisition of a licence and a good large-aperture lens: Henry Collen quickly set about obtaining both.

Talbot granted him the first calotype licence,[6] and the optician ANDREW ROSS constructed for him the first British portrait lens (1841), and the first in which the visual and chemical foci were coincident. It was a double combination with a diaphragm between the two plano-convex components.[7] An unusual feature of the first camera which Ross designed for use with it was that the image was not received on a flat piece of paper, but the prepared sheet was pressed between two *curved* glass plates, to correct the curvature of field of the lens. In the second, smaller camera the image was received in the usual way on a flat piece of paper.

The exact date when Henry Collen started taking portraits is not known, but he mentions a portrait of Charles Babbage taken in August 1841,[8] thus following hard on the heels of Beard and Claudet. His studio at 29 Somerset Street, Duke Street, near Portman Square, was the first calotype studio. Portraits were at first taken in a glass-covered yard at the back of the house, modifications to the lighting being effected by mirrors.[9] During December the exposures were 1 minute, but in the following spring this was greatly reduced, for Collen impressed on prospective clients the great advantages inherent in the process *he* was using: 'A sitting of a few seconds is all that is required for taking a portrait, of which any number of copies may be produced.'

Believing that the marriage of the old and the new methods of portraiture would give a still more perfect result, Collen used the photographic image as a basis for his artistic skill: 'he corrects any imperfection in the drapery or supplies any defects in the figure, so that his works have an entirely different aspect from those of the amateur, who must, generally speaking, be content with the results which the process gives him'.[10] Sir David Brewster considered Collen's portraits 'infinitely superior to the finest miniatures that have ever been painted', but this was only one of many fallacious statements on artistic matters, about which this eminent scientist knew little. 'The artistic effect in these representations is susceptible of being much heightened by the brush, and the defects of expression might be removed, and the likeness in consequence greatly improved, by one or more subsequent sittings.'[11] To human vanity, straightforward photographs, untouched by the artist's pencil or brush, appear mechanical and lacking in artistic feeling. The chief propagators of this idea were, in the first place, miniaturists and minor painters whose very livelihood seemed threatened by the new art. However, while delicate tinting of daguerreotypes had perhaps some justification because portraits on polished silvered plates were difficult to see, and the taste of the time considered them to have 'a ghastly, corpse-like hue', retouching (a thing impossible on daguerreotypes, and introduced by Collen on paper photographs) will always be objected to by purists because it constitutes a most injudicious mixture of two diametrically opposed artistic media.

In spite of the praise bestowed upon Collen's calotype miniatures, they were apparently no match for daguerreotype portraits, on account of the grain of the paper, which precluded fine detail and after a little more than a year he returned to miniature painting.

Ironically, the few photographs which have survived out of Collen's total output of about one thousand portraits[12] have largely faded, and it is only his pen and brush strokes which give substance to the ghost-like portrait.

Thereupon (October 1842) Talbot tried to persuade Claudet, the acknowledged master of daguerreotype portraiture, to adopt the calotype at the Adelaide Gallery. Talbot stipulated that he should receive 25% of the takings on calotype portraits (the price of which was to be 1 guinea, and 5*s.* for extra copies), and that he should be free to grant other licences in London should his share fall below £400 in one year. This latter point proved a stumbling-block, and negotiations dragged on for eighteen months.[13] Eventually in July 1844 Claudet bought a licence and was instructed in the process by Henneman, Talbot's ex-valet and assistant. For nearly two years Claudet produced calotype or daguerreotype portraits, according to the wish of the sitter. The price of a portrait 'on a half sheet of letter paper' ($4\frac{3}{4}$ in. × $6\frac{1}{2}$ in.) was 1 guinea, and of every subsequent copy 7*s.* 6*d.* On a quarter sheet of paper the charge was half a guinea, and 5*s.* for each additional print. Incidentally, it was Claudet (and not Sir David Brewster, as is often stated) who first publicly suggested–at the time of taking out his licence–that the calotype 'may more justly be named Talbotype, from the same feeling which has caused the name of Daguerre to be given to his valuable discovery'.[14] However, calotype portraiture was not a commercial success.

THOMAS WYATT, secretary of the Birmingham Society of Artists, and portrait painter of some reputation in the Midlands, was induced by the novelty and success of the calotype process to pay its inventor a considerable sum in the mid-1840s for the sole right of practising the art in Manchester and surrounding districts. This proved a most unfortunate speculation, for Wyatt received no adequate return for his investment, and after struggling on for several years he died a pauper.[15]

Though no patent restrictions hampered the calotype in Scotland, HILL'S AND ADAMSON'S studio in EDINBURGH was the only professional calotype establishment north of the Border.

A number of Scottish scientists, foremost among them SIR DAVID BREWSTER and DR JOHN ADAMSON, both of St Andrews University, experimented with Talbot's process, and the first calotype portrait in Scotland–if not in the world–was taken by
Pl 67 Dr Adamson in May 1841. Both negative and positive of this portrait are preserved

at the Royal Scottish Museum, Edinburgh. The legend in Dr Adamson's handwriting underneath the portrait reads:

> This negative Calotype was taken in spring (May) of 1840 by Mr. Fox Talbot's process, and before he had made it public [10 June 1841]–he explained the process in a letter to Sir D. Brewster [May 1841], and this picture was obtained by following his directions and using a temporary camera obscura made with a common small lens, a burning glass an inch and a half in diameter–it is no doubt the first Calotype portrait taken in Scotland. The sitting lasted nearly two minutes in bright sunshine.

As pointed out elsewhere[16] Dr Adamson made a slip in altering the date to 1840, perhaps many years later when forgetful of the date of the introduction of the calotype, for he wrote on another page of the album, 'Mr. Fox Talbot's discovery in the spring of 1840', which date has likewise been altered from 1841.

The Adamson album contains many early photographic experiments by him and his younger brother Robert. ROBERT ADAMSON, the son of a farmer at Burnside near St Andrews, had from early youth been interested in engineering, but his health was not strong enough for the hard work entailed by his apprenticeship to a millwright; in 1842 he was, therefore, persuaded by his brother to turn his attention to photography, which held out great prospects for the future. Talbot had asked Brewster in the first half of 1842 whether he could induce anyone to practice calotype portraiture professionally in Scotland. In August Brewster reported back that 'a brother of Dr. Adamson . . . is willing to practice the calotype in Edinburgh as a profession.'[17] Using a camera made by Thomas Davidson, Robert Adamson was instructed in the calotype process by his brother, and by August he mastered the manipulation and photographed some of his mechanical models and views near his home and at St Andrews. Some of these are initialled 'R.A.' and dated 1842. In the collection of calotypes at the Scottish National Portrait Gallery there are a few unsigned portrait groups in style undoubtedly attributable to Robert Adamson, a series of whose portraits taken in 1842 was exhibited many years later at the British Association meeting in Aberdeen.[18] Pl 68

It was not long before Sir David Brewster remarked upon the great skill and experience of Robert Adamson: 'several photographs have all the force and beauty of the sketches of Rembrandt, and some of them have been pronounced by Mr Talbot himself to be among the best he has seen. Mr Adamson is about to practise the art professionally in our northern metropolis.'[19]

As this reference to Adamson's professional activities was published four months before the formation of the Free Church of Scotland, an event which led David Octavius Hill to take up photography, it is clear that Robert Adamson had already opened his portrait studio at Rock House, Calton Stairs, Edinburgh, *before* Hill was ever mentioned in this connection. Indeed, in an article on 'The Calotype' published in *The Witness*, Edinburgh, 12 July 1843, the writer–probably the editor Hugh Miller–'recommends a visit to the Studio of *Mr. Adamson* and urges the encouragement of *his* art.' (authors' italics). The opinion advanced by Dr Heinrich Schwarz that Hill took up photography as early as 1840 is incorrect.

DAVID OCTAVIUS HILL was the eighth child of a book seller and publisher in Perth. Pl 71 Displaying artistic talent as a boy, he learnt the new technique of lithography, and in 1821 Thomas Hill began publishing in six parts his son's first work, a set of thirty *Sketches of Scenery in Perthshire drawn from Nature and on Stone by D. O. Hill*–one of the earliest lithographic works in Britain.

At the age of nineteen Hill moved to Edinburgh to study under the landscape painter Andrew Wilson. The following year he exhibited three landscapes, and thereafter picturesque Scottish, English, and Irish scenery formed the ever-recurring theme of his paintings, revealing his love of wild scenery with ancient castles, rugged mountains, romantic glens, gnarled trees, poetic sunsets over rivers, and waterfalls. Such subjects greatly appealed to contemporary taste, nurtured on the poems of Byron and the novels of Sir Walter Scott, and Hill was obviously absorbed by the Romantic Movement. In the late 1830s he illustrated an edition of the works of the 'Ettrick Shepherd' (James Hogg) for the Glasgow publisher Blackie, which was followed in 1840 by *The Land of Burns*, in which sixty-one out of the eighty-one steel engravings were copied from landscapes specially painted by Hill of scenes associated with the life and works of Robert Burns.

During his lifetime Hill exhibited no fewer than 291 paintings and sketches at the Royal Scottish Academy (of which he was a founder-member, and secretary from 1830 to 1869) and at the Institution for the Encouragement of the Fine Arts in Scotland; in addition, four pictures were hung at the Royal Academy in London.

Hill was a successful and respected artist in his day, but the few paintings by him Pl 69 which have survived–though quite charming–would hardly rescue him from oblivion. It is his photographic portraits which have made Hill's name famous all over the world, and this is perhaps the best proof we have that photography can be an art in its own right.

How did Hill, a landscape painter, come to take up photographic portraiture? At the end of May 1843 occurred an event which made a profound impression on Hill. After ten years of conflict, over 470 ministers of the Church of Scotland resigned on a matter of principle: the right of congregations to choose their own ministers instead of having them appointed by the Queen or by landed proprietors. The sacrifice of these men who gave up their livelihood and privileges for an ideal deeply moved Hill, and he set himself the task of commemorating the event in a monumental painting of the historic meeting. He was *not* commissioned as has frequently been stated.

When the excitement of the occasion had died down, Hill began to realize the tremendous difficulty of his self-imposed task; how was he to set about it, he who had never painted a portrait before? Sir David Brewster–who as an ordained minister had taken an active part in the demonstration and was a member of the Free Church Committee–persuaded Hill of the advantages of having photographic portraits taken to serve as guides for his painting. He put Hill in touch with Robert Adamson and in July they began to collaborate in taking single and group portraits of some of the participants in the first General Assembly of the newly formed Free Church of Scotland. The sitters were posed by Hill and photographed by Adamson. According to the article in *The Witness* referred to above the largest group exhibited at the gallery of Hill's brother Alexander, a printseller in Princes Street, Edinburgh, in July 1843 showed Dr Thomas Chalmers in the Moderator's chair surrounded by eighteen or twenty of the better-known members of the Church.

As time went on it turned out to be an ideal association in which both partners played an equally important part: Adamson's technical skill was indispensable to Hill, who in his turn showed an artistic conception of an unusually high order, a masterly sense of form, and a sure instinct for bold and simple composition. The Pls 70, 72 portraits are powerful in characterization. Details of dress and accessories are subordinated in order to concentrate the more on head and hands; the massing of light and shade and perfect ease of pose constitute their chief charm. They have grandeur, power, and originality; they are, in short, imbued with the quality of Old Masters.

It was fortunate that Adamson worked with the paper process, for the broad artistic effects of the calotype with its warm sepia to purplish tones suited Hill's pictorial conception much better than the daguerreotype would have done.

Since the photographic material was not very sensitive, an exposure of 1 or 2 minutes[20] (according to negative size) in direct sunshine was essential, and the sitters were posed outside Rock House, either singly or in groups. By a skilful arrangement of curtains, tables, and chairs, Hill and Adamson convey a convincing impression of an interior. Adamson used several wooden cameras of different sizes, fitted with Thomas Davidson's symmetrical portrait lens, which was excellent, though not as fast as Petzval's. The usual negative size of the Hill-Adamson photographs is 6½ in. × 8½ in., but some are smaller, and several in the Gernsheim Collection measure 9½ in. × 11½ in. and one even 12 in. × 16 in.

Hill's and Adamson's reputation spread rapidly, and many distinguished men and women came to Rock House to have their portraits taken. Among them were the Marquis of Northampton, P.R.S., William Etty, R.A. (the portrait of whom in the National Portrait Gallery was copied from the calotype), Sir Francis Grant, P.R.A., Lady Eastlake, Mrs Anna Brownell Jameson, Christopher North, Lord Robertson, James Nasmyth, Sir John McNiell, Lady Mary Ruthven, and visiting Pl 73 royalty (the King of Saxony).

Far from limiting themselves to portraying Scottish society, Hill and Adamson frequently took their camera to nearby seaside villages to photograph fishing boats, sailors, old stone cottages, and fisherfolk in their picturesque costumes. Their subjects Pl 74 also include architectural views of Roslyn Chapel, St Andrews, and Edinburgh, where Greyfriar's churchyard with its ivied walls and old tombs was a favourite hunting-ground for picturesque backgrounds for groups. Curiously enough, though Hill was a landscape painter there are only about two dozen photographic landscapes by him and Adamson.

Contemporary critics were full of admiration for these pictures, and to satisfy the eager demand the partners prepared several very large albums at a price of £40–£50.[21] Today, these albums count among the greatest treasures of photography and are–like single prints–eagerly sought after by museums all over the world. Hill gave the marine painter Clarkson Stanfield in October 1845 a particularly fine album of which he wrote: 'I sat up till nearly three o'clock looking over them. They are indeed most wonderful, and I would rather have a set of them than the finest Rembrandts I ever saw.' This splendid album, now in the Gernsheim Collection, contains over one hundred calotypes which have preserved their deep rich colour with no sign of fading. Other albums of one hundred calotypes are at the Edinburgh Central Library, the British Museum and the Royal Photographic Society, the first dated 1847 and the others 1848. These four albums have illuminated title-pages painted by Hill, and each photograph is signed by both artists.

In 1846 an album of twenty-two photographs entitled 'A Series of Calotype Views of St Andrews' was produced by Hill and Adamson at their Calotype Studio, Calton Stairs, Edinburgh. Like the other albums, this was not a publication in the proper sense of the word: but a number of calotypes were separately issued with printed titles by Alexander Hill.

Towards the end of 1847 Robert Adamson's health declined, and he returned to his home near St Andrews, where he died in January of the following year at the early age of twenty-seven. During the short space of less than four and a half years Hill and Adamson had produced at least 1,500 magnificent pictures–a fair output considering the limited number of sunny days in the northern climate.

From then onward Hill devoted his life chiefly to painting and to his duties as secretary of the Royal Scottish Academy. He did not altogether abandon his interest in photography, for he became a council member of the Photographic Society of Scotland in 1858, and soon after entered into collaboration for a short while with another Edinburgh portrait photographer, A. Macglashon. Their joint work, though ostensibly championing 'the development of *fine art* in photography', was the worst kind of Victorian trash, for which Hill alone was responsible since the subjects were 'designed and arranged' by him and photographed by Macglashon (by the collodion process). Hill had unfortunately been infected by the misplaced ambition to which many photographers succumbed in the mid-1850s–the desire to imitate paintings. The artistic failure of this short return to photography is perhaps the best proof that Adamson's role had been not merely that of technician, in spite of the fact that Hill used to exhibit their joint productions at the Royal Scottish Academy and in photographic exhibitions as 'Calotype portraits executed by R. Adamson under the artistic direction of D. O. Hill'.

The enormous painting of 'The Signing of the Deed of Demission' (11 ft 4 in. × 5 ft) on which Hill lavished all his spare time for twenty-three years was bought on completion in 1866 by the Free Church, in whose offices it still hangs.[22] It depicts Pl 77 over 470 likenesses, including all the leading resigning ministers and prominent sympathizers and friends, among them Sir David Brewster, Hill's wife and sister, Adamson with the camera, and Hill himself, significantly, with sketchbook and pencil. A number of the people in this crowded painting, which has rather the appearance of a 'photographic mosaic', can be identified by the Hill-Adamson photographs from which they were in many cases copied.

When Hill died on 17 May 1870 neither newspapers nor art journals referred to his photographic work. More surprising still, no photographic journal even mentioned his death. It was not until the 1890s that his and Adamson's work was rescued from oblivion by J. Craig Annan, a leading Scottish photographer of the day, whose father had been a friend of Hill's, and who was himself a great admirer and champion of his work.

Today David Octavius Hill and Robert Adamson are universally accorded first place in the annals of photography. The artistic spirit with which their photographs are imbued has impressed all succeeding generations, and it is indeed astonishing that in its very first years the new art should have reached its highest peak in the magnificent achievements of these two Scottish photographers.

OTHER PAPER PROCESSES

Talbot did not publish a manual on his process–presumably fearing this would make things easier for would-be infringers. The need for one was generally felt despite W. Raleigh Baxter's brochure *The Calotype Familiarly Explained*, London 1842. George S. Cundell's instructions unfortunately remained entombed in the *Philosophical Magazine*, May 1844. Strange to say, the first manual on the calotype process appeared in Germany in 1841: *Lichtbilder (Portraits) auf Papier in ein bis zwei Minuten darzustellen, von Talbot, Physiker in London*.[23] Brief manipulatory details were included in a number of general treatises which appeared in the forties, the very titles of which tended to add to the bewilderment of the amateur, and were far from conducive to confidence: e.g. Robert Bingham's *Photogenic Manipulation* [1848], *containing the theory and plain directions in the art of photography, or the production of pictures through the agency of light: including Calotype, Fluorotype, Ferrotype, Chromotype* [sic], *Chrysotype,* *Cyanotype*, *Catalisotype* [sic], *and Anthotype*. All of these 'types', except Cyanotype, were poor and unreliable and failed to find practical application. A brief mention of them will therefore suffice.

Amphitype. Announced by SIR JOHN HERSCHEL at the British Association meeting at York in 1844, this process takes its name from the Greek ἄμφω, both, because either negative or positive pictures could be produced, according to manipulation. The exposure time varied from half an hour to five or six hours. The name amphitype, which had been suggested to Herschel by Talbot, was also given by Talbot to a process of his own in 1851, with which Herschel's is not to be confused.

Anthotype. Derives its name from the Greek ἄνθος, flower, because the juices of various flowers, either alone or mixed with a little alcohol, were spread upon paper, instead of mineral salts. Devised by Sir John Herschel and communicated by him to the Royal Society in June 1842, the method was of purely theoretical interest, for it took four to five *weeks* to print a positive from a negative–and even then the result was not permanent.

Catalysotype. Invented by DR THOMAS WOODS of Parsonstown, Ireland, and communicated to the British Association meeting at York in 1844. The paper was prepared with a weak solution of iodide of iron and tincture of iodine. When removed from the camera no picture was visible, but if left in the dark it gradually developed itself, and it was from this catalytic action that the process took its name. The exposures were considerably shorter than those necessary for the talbotype, but the uncertainty of the degree of development was much greater.

Chromatype. This name covers several variants involving the use of any of the salts of chromium. ROBERT HUNT, who coined the name, announced his process to the British Association meeting at Cork in 1843. The paper was prepared with a solution of copper sulphate and potassium bichromate. It produced direct positive photogenic drawings, but was not sensitive enough for use in the camera.

Chrysotype takes its name from the Greek χρυσός, gold, because the image was developed with a gold solution. The process was communicated by Sir John Herschel to the Royal Society in June 1842. Paper was washed over with a solution of ammoniocitrate of iron, and after exposure in the camera was developed with chloride of gold solution. The sensitivity was, in the inventor's own opinion, decidedly inferior to the calotype.

Energiatype, later called *Ferrotype* because protosulphate of iron (ferrous sulphate) was used as developer. Invented and communicated by Robert Hunt to *The Athenaeum* on 1 June 1844, it is not to be confused with the later kind of ferrotype or tintype. Paper was coated with a solution of succinic acid and gum arabic. When dry, it was washed over with a solution of nitrate of silver and could be kept until required. An exposure in the camera of 2 to 8 minutes in sunshine was given. The result was a negative which was developed with protosulphate of iron and gum arabic.

Fluorotype derives its name from the sodium fluoride used in preparing the paper. The introduction of this salt is due to Robert Hunt, who published the process in *Researches on Light*, 1844. The exposure was only half a minute and the picture was developed with protosulphate of iron.

Blueprints. Of all these paper processes only the *cyanotype* found practical application. It is another of Sir John Herschel's inventions, described in his memoir to the Royal Society, June 1842, and derives its name from cyanogen, which in combination with iron plays an essential part in the sensitive coating. Too slow for anything but copying objects by superposition, it is nevertheless the simplest, cheapest, and after platinotype the most permanent photographic printing process: after the paper has Pl 75 been exposed in contact with a plan, for example, it only needs to be washed in cold water. Herschel used to make cyanotypes when he required copies of intricate calculations and other memoranda which he was unwilling to entrust to other hands on account of the danger of inaccuracies in copying, and this is the first record we have of photography undertaking the duties of copying-clerk.

The three volumes of *Photographs of British Algae: Cyanotype Impressions* which MRS ANNA ATKINS distributed among a small circle of people interested in botany and photography are a unique and early application of this process. Mrs Atkins had an important collection of British seaweeds which she bequeathed to the British Museum, and these volumes, which were issued in parts over the period 1843 to 1853, contain 411 plates illustrating the entire series of British seaweeds, copied on the sensitive paper by superposition.[24] The title, preface, and descriptions are 'blue-printed' from the author's handwriting.

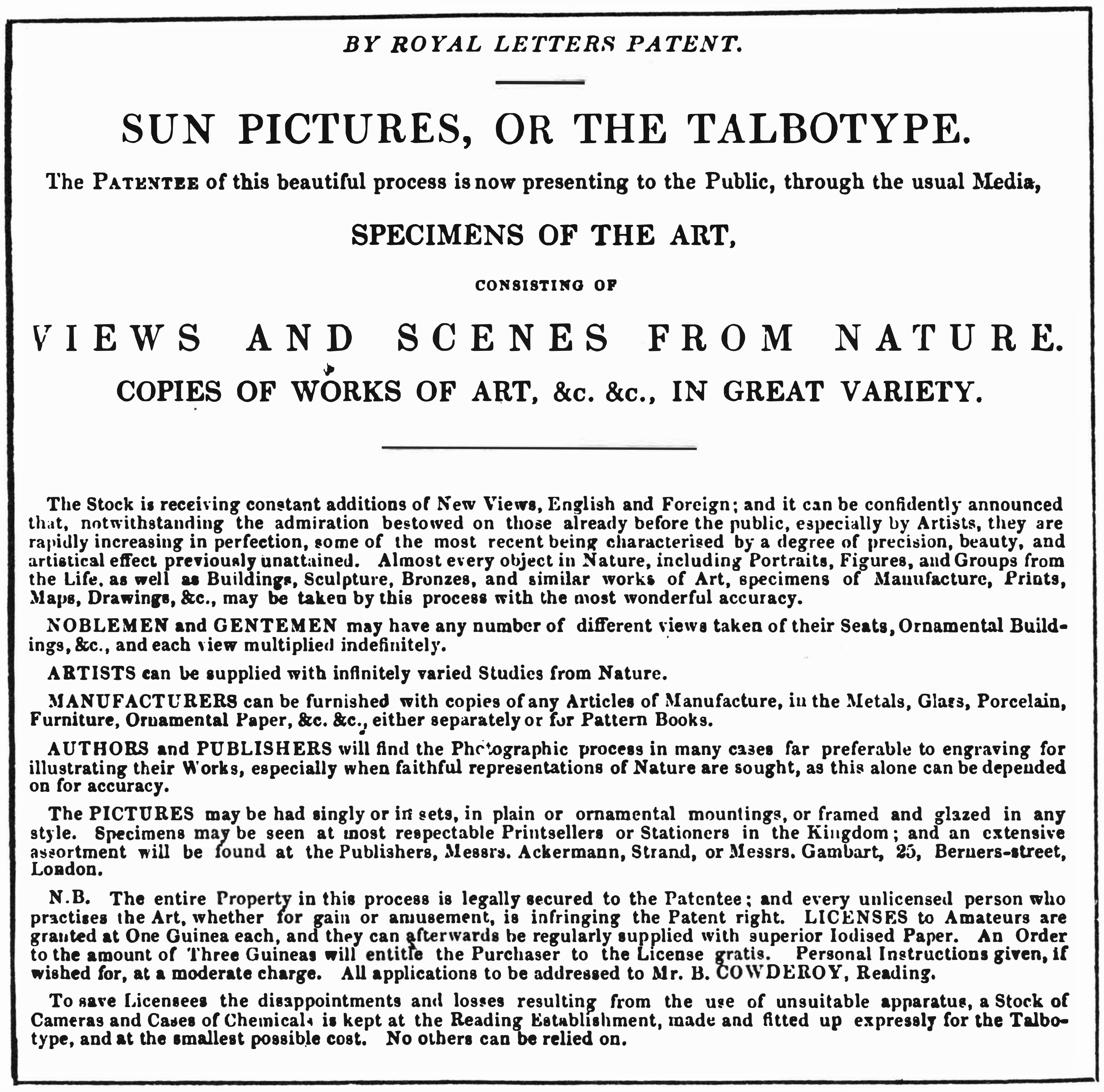
Apart from Sir John Herschel's and Mrs Atkins's applications, the cyanotype remained dormant until about 1881, when Marion & Co., photographic publishers, reintroduced it under the name 'ferro-prussiate or blue process'. They sold prepared paper to amateurs to imprint leaf patterns, and to government departments, shipbuilders, railway companies, engineers, contractors, architects, etc., for the quick and cheap reproduction of drawings, patterns, and plans, and this process remained in favour as the 'blueprint', the picture being in white lines on a Prussian-blue ground.

An historical application of Herschel's method occurred during the Boer War, when the defenders of Mafeking ran short of money and stamps. Having no other means at his disposal but to issue them himself, Lieut.-Colonel Baden-Powell turned to an amateur photographer, E. J. Ross, who, unable to make albumen paper because there were no eggs, used this simple photographic method. Five negatives were made from Baden-Powell's design of a pound note, and 100 prints copied from each. The 'Mint' was a dugout, and Ross succeeded in turning out twenty pound notes a day.[25] As a safeguard against counterfeit each note bore two actual signatures. For stamps, two different designs were used, for the values of 1*d*. and 3*d*., the latter with a portrait of 'B.-P.'. Both bear the inscription 'Siege of Mafeking'.[26]

PROPAGANDA FOR THE CALOTYPE

As there were no more than about a dozen users of the calotype in the early and mid-1840s, Talbot made special efforts to popularize it. He sold 'Sun Pictures' of English and Irish scenery and copies of works of art through printsellers and stationers all over Britain, and brought out several publications illustrated with actual talbotypes to demonstrate the chief advantage of his process over the daguerreotype, which did not lend itself to multiplication and publication.

In order to produce the thousands of prints necessary for these publications Talbot needed a printing establishment. It was obvious that such a commercial undertaking could not be suitably carried on at his grand country seat, and Reading was chosen as a convenient place lying on the newly opened Great Western Railway almost halfway between Lacock Abbey and London. Here Talbot set up his former valet and photographic collaborator NIKOLAAS HENNEMAN in the autumn of 1843. Henneman worked in a house which had formerly been used as a school, containing a large room which was always kept locked; this circumstance, and the mysterious deliveries of paper and chemicals, led prying neighbours to the conclusion that Henneman, who spoke broken English (he was Dutch by birth), was engaged in forging bank-notes, or some such nefarious pursuit.



BY ROYAL LETTERS PATENT.

SUN PICTURES, OR THE TALBOTYPE.

The PATENTEE of this beautiful process is now presenting to the Public, through the usual Media,

SPECIMENS OF THE ART,

CONSISTING OF

VIEWS AND SCENES FROM NATURE.

COPIES OF WORKS OF ART, &c. &c., IN GREAT VARIETY.

The Stock is receiving constant additions of New Views, English and Foreign; and it can be confidently announced that, notwithstanding the admiration bestowed on those already before the public, especially by Artists, they are rapidly increasing in perfection, some of the most recent being characterised by a degree of precision, beauty, and artistical effect previously unattained. Almost every object in Nature, including Portraits, Figures, and Groups from the Life, as well as Buildings, Sculpture, Bronzes, and similar works of Art, specimens of Manufacture, Prints, Maps, Drawings, &c., may be taken by this process with the most wonderful accuracy.

NOBLEMEN and GENTEMEN may have any number of different views taken of their Seats, Ornamental Buildings, &c., and each view multiplied indefinitely.

ARTISTS can be supplied with infinitely varied Studies from Nature.

MANUFACTURERS can be furnished with copies of any Articles of Manufacture, in the Metals, Glass, Porcelain, Furniture, Ornamental Paper, &c. &c., either separately or for Pattern Books.

AUTHORS and PUBLISHERS will find the Photographic process in many cases far preferable to engraving for illustrating their Works, especially when faithful representations of Nature are sought, as this alone can be depended on for accuracy.

The PICTURES may be had singly or in sets, in plain or ornamental mountings, or framed and glazed in any style. Specimens may be seen at most respectable Printsellers or Stationers in the Kingdom; and an extensive assortment will be found at the Publishers, Messrs. Ackermann, Strand, or Messrs. Gambart, 25, Berners-street, London.

N.B. The entire Property in this process is legally secured to the Patentee; and every unlicensed person who practises the Art, whether for gain or amusement, is infringing the Patent right. LICENSES to Amateurs are granted at One Guinea each, and they can afterwards be regularly supplied with superior Iodised Paper. An Order to the amount of Three Guineas will entitle the Purchaser to the License gratis. Personal Instructions given, if wished for, at a moderate charge. All applications to be addressed to Mr. B. COWDEROY, Reading.

To save Licensees the disappointments and losses resulting from the use of unsuitable apparatus, a Stock of Cameras and Cases of Chemicals is kept at the Reading Establishment, made and fitted up expressly for the Talbotype, and at the smallest possible cost. No others can be relied on.

Fig 17 Advertisement of Talbot's Reading establishment, 1846

When early in 1844 Henneman could no longer cope with the expanding business single-handed, Talbot took on several more assistants including Thomas A. Malone, and had an outhouse built in the garden, with a glass-house for portraiture, and soon the photographic work was carried on in broad daylight at what subsequently became known as Talbot's Reading Establishment. It was situated at the premises now known as 55 Baker Street, and a plaque to commemorate this first photographic printing establishment was unveiled by Talbot's grand-daughter on 9 June 1951. A contemporary photograph gives some idea of the various activities that were carried Pl 78
on. We see a photographer making a reproduction of an engraved portrait, a man having his photograph taken, an assistant attending to printing-frames for positive copies, and another taking a sculptured group of the Three Graces; each photographer, it will be observed, has a clock for timing the exposure.

From the Reading establishment talbotype apparatus, as well as chemicals and Fig 17
iodized paper, were supplied to amateurs who had taken out a licence the price of which had been reduced to 1 guinea, and was even given free if photographic material to the value of 3 guineas was ordered. It closed in spring 1847 after Henneman had completed the last major undertaking, the printing of the 1,675 calotypes for Sir William Stirling's *Annals of the Artists of Spain*, which was published in August 1848.

The Pencil of Nature,[27] the first photographically illustrated book in the world, Fig 18
came out in six parts beginning on 29 June 1844, each containing from three to seven
photographs. A few days earlier Talbot informed the editor of *The Literary Gazette*: Pl 76

> I have met with difficulties innumerable in this first attempt at photographic publication, and I therefore hope all imperfections will be candidly allowed for and excused. I have every reason to hope the work will improve greatly as it proceeds, and that British talent will come forward and assist the enterprise. The complexity of the art requires a division of labour. One person should invent new

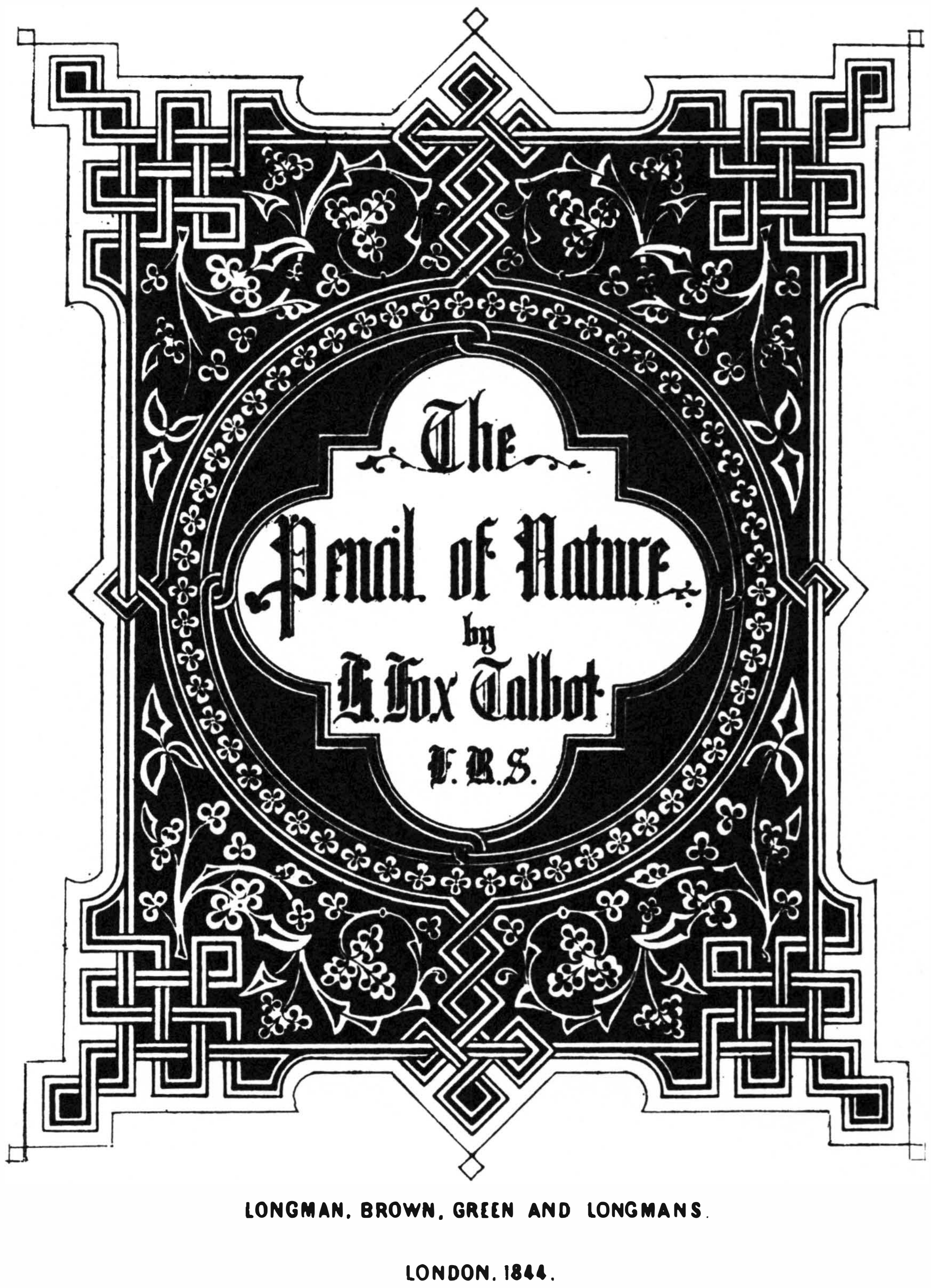


Fig 18 Cover of 'The Pencil of Nature', 1844

processes while another puts in execution those already ascertained, but hitherto I have been the chief operator myself in the different branches of the invention.'[28]

Seven months elapsed before the appearance of Part II on 31 January 1845, and Part VI was not published until 23 April 1846.[29] No wonder editors got tired of waiting for the issues! The editor of *The Athenaeum* complained, 'The irregular appearance of *The Pencil of Nature*, the small number of pictures those parts contain, and the high price at which they are sold, all prove that the labour consequent on the production of photographs is too great to render them generally useful for the purposes of illustration.' In spite of the different publication dates, the imprint on the cover is in every case 1844.

The most interesting part of this extremely rare work is the introduction to Part I, in which Talbot relates the history of his invention. To avoid possible misunderstanding and to stress once more the novelty of the publication, a 'Notice to the Reader' was inserted on a slip, which reads 'The plates in the present work are impressed by the agency of light alone, without any aid whatever from the artist's pencil. They are the sun pictures themselves, and not, as some persons have imagined, engravings in imitation.'

Talbot fully succeeded in demonstrating the various applications of his process–except portraiture: among the twenty-four plates of the complete work are architectural views, landscapes, photographs of sculpture, still-lifes, reproductions of engravings, and photogenic drawings of botanical specimens and lace. Only one photograph, 'The Ladder', includes figures, and Talbot writes of this rather quaintly: 'Groups of figures take no longer time to obtain than single figures would require, since the camera depicts them all at once, however numerous they may be.'

Many of Talbot's photographs are rather matter-of-fact records, showing the scientist at work, but a few are first-rate compositions–'The Open Door', 'The Cloisters at Lacock Abbey', 'The Fruit Sellers', 'The Chess Players' and 'The Ladder', Pl 80 'The Courtyard at Lacock Abbey' (not all of which are in *The Pencil of Nature*). This marked difference in style is puzzling until one learns that for them Talbot had the collaboration of an artist–his friend Henry Collen. On one occasion, Talbot wanted to photograph a ladder leaning against an open loft door high above ground level. Pointing the camera up, he produced a distorted effect. Collen remonstrated with him: 'You are not going to take it so, surely!' to which Talbot replied, 'We cannot take it any other way'. Collen protested that as an artist he would rather not take it at all than produce a distorted picture.[30] His argument seems to have prevailed, for the picture, 'The Ladder', shows no distortion whatever; presumably the difficulty Pl 79 was overcome by taking the subject from a greater distance, or from a higher position, or both. At the time referred to (about 1843) cameras were not yet fitted with a rising and falling front.

Apropos of another picture, 'A Scene in a Library', Talbot made a prophetic speculation as to the possibility of photographing in a completely dark room by admitting only the invisible rays of the spectrum.

> If there were a number of persons in the room, no-one would see the other: and yet nevertheless if a camera were so placed as to point in the direction in which anyone were standing, it would take his portrait and reveal his actions, for the eye of the camera would see plainly where the human eye would find nothing but darkness. Alas! that this speculation is somewhat too refined to be introduced with effect into a modern novel or romance, for what a *dénouement* we should have, if we could suppose the secrets of the darkened chamber to be revealed by the testimony of the imprinted paper!

How delighted Talbot would have been, could he have known that his idea of photographing in the dark was in fact achieved by infra-red rays 84 years later.

Sun Pictures in Scotland, Talbot's second photographic publication, appeared between Parts IV and V of *The Pencil of Nature*, in the autumn of 1845. It differs from *The Pencil of Nature* in the absence of letterpress, apart from a printed title-page and list of plates, but Talbot found it again advisable to insert the 'Notice to the Reader' slip. *Sun Pictures* contains twenty-three photographs (some 6 in. × $7\frac{1}{2}$ in., others only 4 in. × $3\frac{1}{4}$ in.), on the whole rather uninspired views of Abbotsford and other places associated with Sir Walter Scott.

How many copies Longmans issued of these two books is unknown, but they must have been in very small editions, judging from their extreme rarity.

In a further effort at publicity, Talbot presented in June 1846 with each issue of *The Art Union* a specimen photograph to illustrate an editorial on the talbotype.

> This will be a great boon to our readers [wrote the editor], many of whom, although they have heard much of the wonderful process, have not been yet enabled to examine an actual specimen. Many months have been occupied by the assistants of Mr Talbot, under his directions, in procuring the large number of impressions necessary for our publication; and it will be obvious that under other circumstances it would have been impossible for us to have presented to our subscribers so valuable and costly a boon.

Some idea of the magnitude of the undertaking can be gained from the fact that the certified circulation of *The Art Union* was over 7,000 per month in 1846. Talbot presented only pictures taken from nature, and each of the eight *Art Union* copies for June in the Gernsheim Collection contains a different picture. Like the prints sold at stationers', the mounts bear a label on the back:

PATENT
TALBOTYPE
OR
SUN PICTURES

More unusual are labels imprinted:

PATENT
TALBOTYPE PHOTOGENIC DRAWINGS

For the first edition of Sir William Stirling's *Annals of the Artists of Spain* (1848) Henneman prepared a supplementary (fourth) volume with photographic title page and sixty-six calotypes of monuments, sculpture, drawings and engravings of paintings, which was issued in a limited edition of twenty-five copies. This publication is noteworthy as the first of many photographically illustrated art books, and in the foreword Stirling expressed the hope that the photographs would 'induce abler contributors to the history of art to illustrate their works by the Pencil of Nature'.

In 1847 Talbot started yet another venture, a calotype portrait studio, which was opened in the spring at 122 Regent Street, London, under the management of Nikolaas Henneman and THOMAS AUGUSTINE MALONE. Through the influence of Talbot's half-sister Caroline, Countess of Mount Edgcumbe, a Lady-in-Waiting to the Queen, Henneman was appointed Photographer on Paper to Queen Victoria, but in spite of royal approval, the studio did not pay at first: from September to December 1847 Henneman lists a mere forty-seven portraits as income.[31] These were considered 'exceedingly beautiful, but inferior on the whole to the artistic photography of Messrs Hill and Adamson of Edinburgh, or those of several members of the Photographic Club'.[32]

In June 1848 Henneman and Malone bought the interest in the Regent Street Street studio from Talbot. Later, they opened a small establishment in the suburbs of London for the printing of positive copies, and from September to November 1851 Henneman was busy printing the 20,150 photographs of the Great Exhibition building and exhibits for the Royal Commissioners and Executive Committee needed for 130 presentation copies of the 'Reports of the Juries'. 'But', Talbot writes, 'they are so extraordinarily stingy, notwithstanding they have a surplus of £200,000, and make such hard conditions with him, that it is doubtful whether he will earn anything by his labour.' The negatives of these Crystal Palace photographs had been taken by C. M. FERRIER of Paris on albumenized glass plates, and HUGH OWEN of Bristol by the calotype process. Henneman's positives were printed on Talbot's silver chloride paper, also called 'plain salted paper' because it was made with common salt and nitrate of silver. One hundred and fifteen magnificently bound sets of the 'Reports of the Juries', each four-volume set containing 155 photographs size 8½ in. × 6½ in., were presented to the Queen, Prince Albert, Cabinet Ministers, foreign governments, the Colonies, the Exhibition Commissioners, the British Museum and a few other institutions. In addition, in consideration of Talbot's waiving his patent rights for this publication, he was given fifteen sets for presentation to his friends, each volume bearing the inscription 'This work on the results of the Great Exhibition of 1851, illustrated with photographic plates, being one of fifteen copies given by the Royal Commissioners to H. F. Talbot, Esq., of Lacock Abbey, as inventor of this branch of the photographic art, was by him presented to. . . .' According to Harold

White, the Commissioners valued each set at £30, so that Talbot received payment in kind of £450, and he gave £200 in cash to Henneman for his work.

Of the several publications illustrated with calotypes, only those contained in the 'Reports of the Juries' have been preserved in a fairly good condition. All the earlier ones have faded very badly, and the bleached impressions entirely fail to convey any idea of their original beauty and richness. Indeed, a printed slip inserted in some copies of the *Talbotype Illustrations to the Annals of the Artists of Spain* states 'The faulty impressions in this volume may be exchanged for others on application to Mr Henneman, 122 Regent Street' (London). In July 1849 Malone informed Talbot, 'we are constantly and unpleasantly cross-examined on the subject. The *Art Union* copies containing the sun pictures seem to have done harm. The artists who have them are interested in giving every publicity to the fact of their growing faintness.'

The same difficulty was experienced in France, apart from the developed prints turned out at Blanquart-Evrard's Lille establishment. For example, Pierre Tremaux's *Voyage au Soudan oriental* illustrated with calotypes and issued by Borani et Droz, Paris, in parts beginning in January 1852, after the twenty-third part changed over to lithographs copied from his calotypes because it was found that the photographs were not durable. Fading–the bugbear of early photographers–can usually be ascribed to insufficient fixing or rinsing of the prints; in some cases it may also be due to the starch in the mount, or acids contained in the mounting paste. In the case of the prints made at the Reading establishment, a fresh solution of hyposulphite of soda was used for each batch of about twenty-five whole-plate prints, in which they remained for about 10 minutes, and were then washed in only three or four changes of water, instead of six to eight. T. A. Malone admitted later that a trace of the destructive hypo was purposely left in the pictures in order to obtain a deep purplish tone by applying a hot iron to the paper; pictures repeatedly washed, he stated, would not take this colour.[33] This statement seems to give the reason for the fading of so many of Talbot's prints, whereas those of Hill and Adamson, made at the same period, are usually well preserved, though some show the effect of paste at the edges. Their permanence was ascribed by Robert Bingham to the fact that the iodized paper was exposed to sunshine before sensitizing.

Unmistakable signs of fading also worried the purchasers of Collen's and Henneman's portraits, and *Punch* had a good time poking fun at these failures: Fig 19

> One of the advantages or disadvantages, as the case may be, of many photographic portraits is that they fade away by degrees, and thus keep pace with those fleeting impressions or feelings under which it is sometimes usual for one to ask another for his or her miniature.

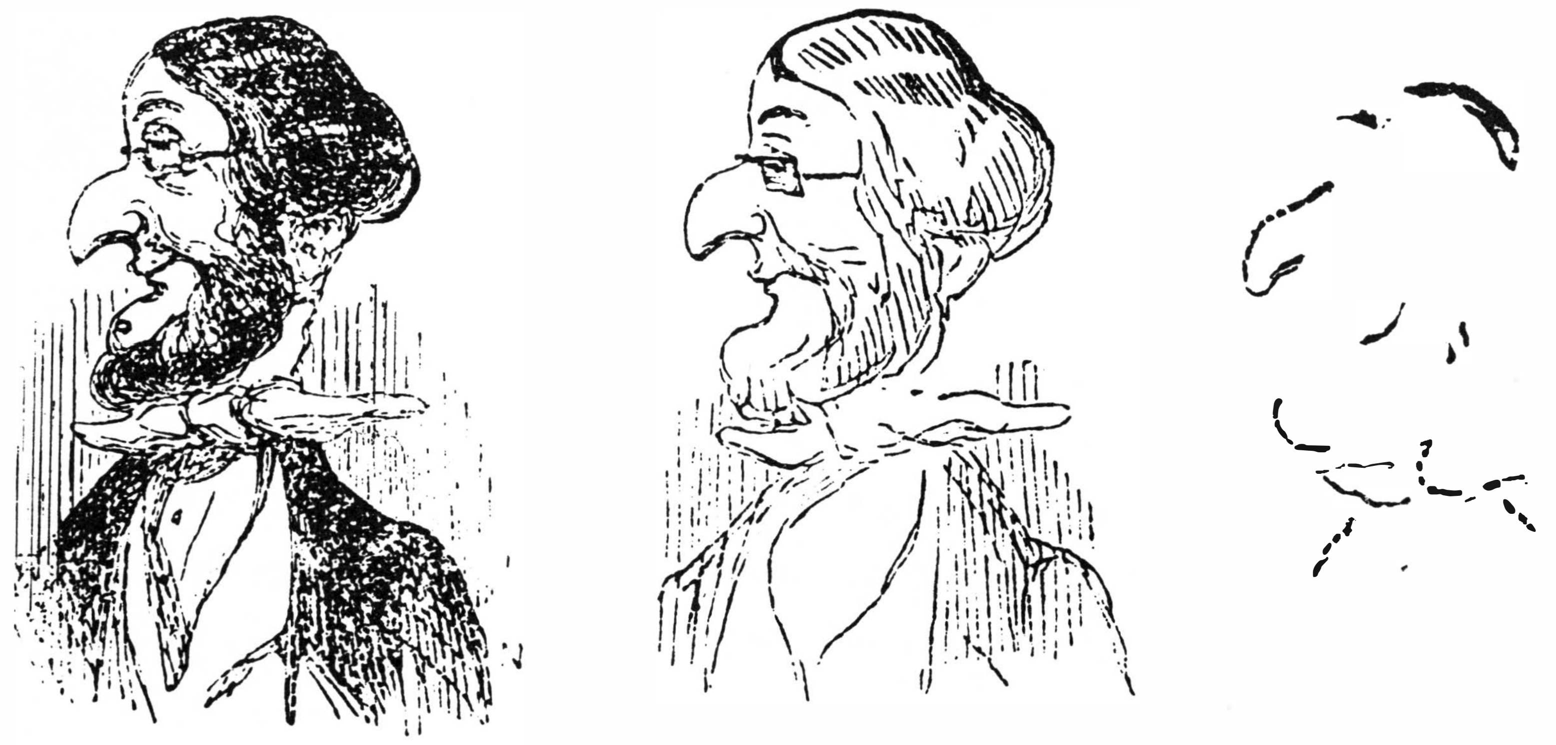


Fig 19 Caricature from 'Punch', 1847

Behold thy portrait!–day by day,
I've seen its features die;
First the moustachios go away,
Then off the whiskers fly.

That nose I loved to gaze upon,
That bold and manly brow,
Are vanish'd, fled, completely gone–
Alas! where are they now?

Thy hair, which once was black and bright,
Much worse than grey has grown;
Indeed, I scarce can say 'tis white,
For 't has completely flown.

Those speaking eyes, which made me trust
In all you used to vow,
Are like two little specks of dust–
Alas! where are they now?

But, ah!–thy portrait of thy love,
Is but a type, no doubt,
And serves its fickleness to prove,
For soon 'tis all wiped out.

Thy hair, thy whiskers, and thine eyes,
Moustachios, manly brow,
Have vanished as affection flies–
Alas! where is it now?[34]

Talbot's many attempts to popularize the calotype did not achieve much success. For professional portraiture it was quite obvious from Collen's, Claudet's, and Henneman's experience that the public preference lay with the daguerreotype. Only a small number of artists and amateurs worked with the paper process: artists, because they preferred the soft mezzotint effect of the calotype to the cold mirror-like daguerreotype; amateurs on account of the cheapness of the materials used and the simplicity of the apparatus and manipulation.

In the autumn of 1847 there was formed in London a Photographic Club, which is sometimes referred to as the Calotype Club because its dozen members all worked with Talbot's process. These keen amateurs, who met once or twice a month at each other's house to compare results and exchange ideas and prints, were PETER WICKENS FRY (founder); ROBERT HUNT, F.R.S., Keeper at the Museum of Practical Geology and the leading authority on photography at the time; ROGER FENTON, barrister; FREDERICK SCOTT ARCHER, sculptor; DR HUGH W. DIAMOND, Superintendent at the Surrey County Lunatic Asylum; SIR WILLIAM J. NEWTON, R.A., miniature painter; PETER LE NEVE FOSTER, barrister, and Secretary of the Society of Arts; FREDERICK W. BERGER; HUGH OWEN; JOSEPH CUNDALL, art historian and publisher; CHARLES VIGNOLES, F.R.S., civil engineer; EDWARD KATER, F.R.S. Four years later additional members included SIR THOMAS MARYON WILSON, BT, and the Royal Academicians RICHARD ANSDELL, JOHN PRESCOTT KNIGHT and JOHN ROGERS HERBERT.[35]

Other notable early calotypists were VERNON HEATH, PHILIP H. DELAMOTTE, and BENJAMIN BRACKNELL TURNER, all artists. The latter is said to have taken some of the pictures for *The Pencil of Nature*, and to have been the last person to abandon the calotype–in 1862.[36] SAMUEL BUCKLE of Peterborough received a Council Medal (the highest award) at the Great Exhibition.

Last but not least, mention must be made of JOHN SHAW SMITH, a gentleman of independent means living in Co. Cork. In 1850–2 he made a tour of southern Europe and the Near East, during which he took about three hundred 9 in. × 7 in. calotype views, which are technically and artistically superior to those of Maxime Du Camp taken about the same time; yet his work remained unknown until 1951 when a number of his negatives were included by us in the exhibition 'Masterpieces of Victorian Photography' at the Victoria and Albert Museum, London. In a talk to the Dublin Photographic Society in April 1857 Shaw Smith described his mode of operation in hot climates. He used the calotype paper moist, and the average exposure was 7 minutes in sunlight, with a lens of 14 in. focal length and an aperture of $\frac{3}{4}$ in. Pls 81, 83 Pl 89

The four patents which Talbot took out in the decade 1841–51 put a most serious check upon the progress of photography in England, for few investigators were disposed to waste time in devising improvements from which they could not reap advantage themselves and from which the public would derive no benefit. Experience proved that Talbot not only modified processes belonging to others and included them in his patents, but he also claimed as coming under his patent important improvements recommended from time to time, and even entirely new processes invented by other investigators and which they had published freely, e.g. the albumen-on-glass and the wet collodion processes. Talbot supported his claims with arguments such as this: 'There are three modifications of the Calotype paper process in general use, known by the names of the Wax paper, Albumen (both on glass and on paper), and the Collodion process. The principle is the same in all. The difference consists either in the adoption of another material to contain the salts of silver, or in a different preparation of the same material.'[37] The crippling effect on the progress of photography is best demonstrated by an examination of some of the points in Talbot's patents.

In the calotype patent of 1841 he included:

(*a*) iodized paper, which had not only been in general use for the past two years, but had in fact even been an article of commerce.

(*b*) The application of gallic acid–the most important part of the calotype process. Yet gallic acid had been used by the Rev. J. B. Reade since 26 March 1839, and gallate of silver had been mentioned by Herschel in a letter to Talbot dated 28 February 1839.

(*c*) 'A mode of obtaining direct positive photographs'. This was only a modification of the principle invented by H. Bayard, Dr Fyfe, Herschel, and others in 1839.

In his patent of 1 June 1843 Talbot included:

(*a*) Hyposulphite of soda for fixing, although this substance had been publicly suggested as a fixing agent by Herschel in March 1839.

(*b*) 'Obtaining enlarged photographs by throwing a magnified image of a small photograph upon calotype paper by means of lenses'–a procedure patented by Alexander Wolcott three months earlier.

In December 1849 Talbot and T. A. Malone patented jointly:

(*a*) 'A method of converting or changing negative photographic images into positive ones.' The picture was produced on a glass plate covered with a film of albumen, the result having the appearance of either positive or negative according to the light in which it was viewed. Albumen-on-glass photographs were invented by Niépce de Saint-Victor, who published his method freely in 1848. The changing negative/positive effect of a picture on glass (covered with a different sensitive coating) had been described by Herschel in February 1840.

(*b*) Exposing positive prints to the vapours of sulphuretted hydrogen 'to give an agreeable tint'–but this substance for darkening photographs had been described by Robert Hunt in his treatise of 1841.

At the British Association meeting at York in 1844 Robert Hunt recommended the use of protosulphate of iron (ferrous sulphate) as developer in his Energiatype and Fluorotype processes. Talbot was invited to comment on it. The matter was so important, he said, that he required some days to consider it. Three or four days later he advanced the pretentious argument that since the effects produced by the iron salt and the vegetable acid (gallic acid) were the same, he had as patentee the right to consider them identical. He included protosulphate of iron in his patent of 1851 as developer in 'his' albumen process.

In his American patent of 1847 Talbot claimed *inter alia* 'the employment of gallic acid in conjunction with iodine and the salts of silver, to render paper extremely sensitive to light, the *gallic acid not having been used in photography previously to my discovery*' (authors' italics).[38] This statement was untrue (see page 91).

Talbot also patented 'photographic publication, or the multiplication of positive photographs' (June 1843)–a point which covered photographically illustrated books as well as the production of positive copies of a picture or print for sale. Thus Talbot held the monopoly for his projected books and the printing establishment at Reading: no photographically illustrated books were published other than those done under Talbot's auspices until after the partial relaxation of his patent rights in July 1852.

Understandably, everyone interested in photography was indignant at Talbot's patenting activities. 'We must confess that we think Mr Talbot is over-doing it by his numerous patents upon what is at best an amusing rather than a valuable art', wrote the editor of the *Magazine of Science* in 1843. 'We really do not see much novelty, and some things we very much question if they will sustain a patent.' Robert J. Bingham complained that 'scientific matters freely given to the world become the general property of the public, and no system of patent laws should sanction the appropriation of them by private individuals'.

The sharpest attack was perhaps that made by the *Imperial Journal of Art:*

> While Mr. Talbot has confessedly the merit of inventing many ingenious processes, it must be admitted that he has exhibited a grasping spirit of monopoly which seems to show that he is animated by other motives than those of a disinterested regard for the promotion of science and the arts. On the part of a person in limited circumstances, no reasonable objection could be urged to such a mode of proceeding, legitimately carried out with the view of improving his condition by the fruits of his industry and ingenuity; but it is a totally different case when a gentleman, already possessed of an independent fortune and claiming the title of philosopher, not only seeks pecuniary advantage by one patent after another for his own admitted discoveries, but even evinces a disposition to appropriate to his own exclusive advantage the discoveries of other enquirers who have given them freely to the world. This has been too much the case with Mr Talbot, who has

been regarded in consequence with anything but friendly feelings by the zealous and disinterested amateurs of the art.[39]

The best indication of the worth of some of Talbot's patents 'which would never have been granted had there been a scientific board to examine the merits of them and test their originality'[40]–a criticism which must have weighed hard on a Fellow of the Royal Society–are the many disclaimers which he entered later on. Of his calotype patent of 1841, containing six points, four were disclaimed; of his patent of 1849, containing five points, four and a half were disclaimed; and of his patent of 1851, containing two points, one point was wholly and the other partly disclaimed.

For the sake of presenting as objective a picture as possible of the stagnation of photography in England we have gone into this matter in greater detail than its retrospective importance would perhaps warrant. Talbot is sometimes presented as a misunderstood and much maligned man suffering from the enmity of photographers. One can sympathize with the neglected inventor; but as usual there are two sides to the story, and as we have seen, the photographers' annoyance was well founded. Ill feeling increased when it transpired that English photographers could not avail themselves of the waxed-paper nor of the albumen-on-glass processes–which had both been freely published in France–except by taking out a licence from Talbot. In consequence, photography made much greater strides in France, and English photographers looked with envy across the Channel. Considering that Gustave Le Gray's and Niépce de Saint-Victor's processes differed entirely from the calotype specification–except, of course, in the general principle of putting a light-sensitive coating on paper or glass–the English argued that 'in taking out a licence from Talbot they would almost acknowledge his right to patent the sun'. And that they resolutely refused to do. In 1851 there occurred, however, two events which were soon to change the position radically.

The first was the Great Exhibition, which was not only the first international exhibition, but also included the first important display of photography. A total of 700 photographs were exhibited by six nations. As a result, lovers and students of the art in all parts of England were brought into contact with the work of Continental and American photographers and with specimens of processes about which they had so far only read and been unable to employ. To many it revealed the isolation in which they had been working. The American daguerreotypes were technically superior to those of any other nation; in photography on paper the French were unrivalled (at least according to the Jurors, for even Hill and Adamson's portraits received only 'Honourable Mention'); while in the albumen-on-glass process Scottish photographers rivalled the French. As in other fields, the Great Exhibition greatly stimulated the dissemination of new ideas and the development of novel methods, and since the pleasure of giving and receiving instruction was mutual, the desire arose before long to unite 'all those gentlemen whose tastes have led them to the cultivation of this branch of natural science' in a full-scale society.

The second event which was to have far-reaching repercussions was **FREDERICK SCOTT ARCHER**'s publication of the collodion or wet plate process in March of that year. This constituted not only a marked improvement on all previous photographic methods, but was the first process free from patent restrictions by its inventor.

FORMATION OF THE PHOTOGRAPHIC SOCIETY

ROGER FENTON, who had studied art with Gustave Le Gray in the studio of Paul Delaroche in Paris, and had there first become acquainted with the new art, went specially to Paris in October 1851 to study the organization of the Société Héliographique, about whose activities he later communicated a detailed report to *The Chemist* (February 1852). The following month he published in the same journal his 'Proposal for the formation of a Photographical Society', and also circulated it to all photographers whose addresses were known.

In this memorandum Fenton outlined a society on the lines of the Société Héliographique, with a regular meeting place, a journal, a reference library, and exhibitions, and he also suggested an annual album to which each member should contribute a photograph, rightly believing that such a collection would form an invaluable record of the advance of photography for future generations.

However, his efforts were thwarted for the time being, because no agreement could be reached with Fox Talbot on the question of patent rights. A committee of six, which included Fenton, Robert Hunt, and other members of the Calotype Club, had for some time been trying to induce Talbot to abandon his monopolistic attitude, realizing that 'the existence of the patents was the great obstacle not only to the formation of the society, but to the improvement of the art itself'. Talbot was quite prepared to play his part by giving a free licence to every member of the Society to practise the art for his own amusement 'provided they on their part acknowledge my rights as inventor and patentee', but he imposed a number of other conditions which the committee found unacceptable.

Undaunted, they held several meetings at the offices of *The Art Journal*, a monthly periodical which took considerable interest in the promotion of photography. John Leighton, F.S.A., an artist, tried to persuade leading scientists to use their influence towards obtaining a baronetcy for Talbot on condition that he relinquished his patent rights, on which he claimed to have spent £7,000,[41] but the first influential person he called upon, Michael Faraday, 'stoutly refused to sign a request that he thought *indigne*, having refused a like honour himself and being averse to such monopolies'. Charles Babbage and Sir John Herschel reacted similarly. The list which John Leighton presented to the Royal Photographic Society in 1899 is a pitiful document containing only eleven signatures, mostly of firms–not a single name of importance.

The Council of the Society of Arts, in the belief that the negotiations might be helped 'by a letter signed numerously and influentially', solicited their members' signatures to an appeal to Talbot. Finally, the feeling of frustration became so general that the biggest guns could be moved into position for attack, and towards the end of July Sir Charles Eastlake and Lord Rosse, the Presidents of the Royal Academy and of the Royal Society, addressed a joint letter to Talbot.

> London, July, 1852.
>
> Dear Sir,–In addressing to you this letter, we believe that we speak the sentiments of many persons eminent for their love of science and art. The art of photography upon paper, of which you are the inventor, has arrived at such a degree of perfection that it must soon become of national importance; and we are anxious that, as the art itself originated in England, it should also receive its further perfection and development in this country. At present, however, although England continues to take the lead in some branches of the art, yet in others the French are unquestionably making more rapid progress than we are. It is very desirable that we should not be left behind by the nations of the continent in the improvement and development of a purely British invention; and as you are the possessor of a patent right in this invention, which will continue for some years, and which may, perhaps, be renewed, we beg to call your attention to the subject, and to inquire whether it

> may not be possible for you, by making some alteration in the exercise of your patent rights, to obviate most of the difficulties which now appear to hinder the progress of the art in England. . . . As we feel no doubt that some such judicious alteration would give great satisfaction, and be the means of rapidly improving this beautiful art, we beg to make this friendly communication to you, in the full confidence that you will receive it in the same spirit–the improvement of art and science being our common object.
>
> Rosse.
> C. L. Eastlake.
>
> To H. F. Talbot, Esq., F.R.S., &c.,
> Lacock Abbey, Wilts.

It may have been unusual to bring such pressure to bear on an inventor to relinquish the rights to which the patent laws entitled him, but the situation had reached an *impasse* which threatened to stifle photography out of existence in England. In the cirsumstances Talbot had no alternative but to relax his stranglehold to some extent, and in his letter of 30 July[42] he announced that he only wished to retain the licensing of professional portraiture–ostensibly in order to protect his licensees, but actually in the belief that the collodion process came under his calotype patent. Some people considered that 'This concession would have come with a better grace at an earlier period', others gave it as their opinion that the single exception of professional portraiture was of little moment: 'No-one cares for portraits on paper now that they are taken beautifully on glass';[43] 'The reservation has certainly been a most unwise one, inasmuch as no person would think of having his portrait taken on paper when by the collodion process, which has never been shackled by any patent restrictions, far more beautiful results can be obtained.'[44] Similar comments appeared in most papers. That this happy illusion was soon shattered will be seen in a later chapter.

Nothing now stood in the way of the formation of a photographic society but Fenton's absence in Russia, photographing the progress of work on Charles Vignoles's bridge over the Dnieper at Kiev. In the meantime the Council of the Society of Arts agreed to hold a photographic exhibition before Christmas, and at the opening soirée on 22 December Roger Fenton read a paper 'On the present position and future prospects of the art of photography'.

The soirée was a great social event and a great event for photography, for this was the first public exhibition in Britain devoted solely to the new art. During the five weeks of preparation the surprisingly large number of 800 photographs had been been brought together, affording a good idea of the condition of photography at the time, for all the then known processes with the exception of the daguerreotype were represented.

Encouraged by the widespread interest which this exhibition aroused everywhere, Fenton called a public meeting to inaugurate the Photographic Society at the Society of Arts on 20 January 1853. At this meeting Sir Charles Eastlake, P.R.A., was voted President of the new Society, Fox Talbot having previously declined an invitation to fill this office. Roger Fenton accepted the post of Honorary Secretary and Sir Charles Wheatstone, the founder of modern telegraphy, became one of the three Vice-Presidents, the others being Sir William Newton and Earl Somers. All the members of the Photographic Club became founder-members. Thus the Photographic Society was born, the *doyen* of the thousands of photographic societies which exist today all over the world, and though preceded in foundation by the short-lived Société Héliographique, the Royal Photographic Society of Great Britain can look back on an unbroken record which makes it the oldest existing photographic society in the world.

On 3 March 1853 appeared the first issue of *The Journal of the Photographic Society* under the editorship of Arthur Henfrey, F.R.S., and on 3 January 1854 Eastlake and Fenton had the honour of conducting the Queen and Prince Albert around the first exhibition organized by the Photographic Society. Nearly 1,500 photographs were on view: the Victorians believed in arranging everything on a vast scale. In 1855 followed the first annual album, and thus within two years all the main points of Fenton's programme for *the promotion of the art and science of photography*, the express object for which the Society had been founded, were realized. A strange omission from the Society's centenary celebrations, was the failure to pay any tribute to Fenton as founder.

THE GOLDEN PERIOD OF PHOTOGRAPHY ON PAPER

Talbot's partial relaxation of his patent rights marks a turning-point in photography in England. At last amateurs could profit by the progress made in France, particularly by Le Gray's waxed-paper process, which appealed to them far more than the rather complicated, though faster, wet collodion of their own countryman. This was for the time being 'monopolized' by professional portraitists. So there began in the summer of 1852 a brief flowering of photography on paper, before it was finally eclipsed by photography on glass. The years 1852–7 are the golden period of the paper negative, and the best manual devoted to the calotype was published as late as 1855 by Thomas Sutton.

Great attention was at last paid, in England and in France, to the choice and manufacture of the paper. It had long been realized that much depended on its quality. It was liable to irregularities of texture and of surface, and was often impure, containing minute portions of brass from the rims of buttons among the rags which were made into pulp. These caused spots in the photographs. For the sake of transparency the paper had to be fine; yet, if too thin, it was not sufficiently rigid to operate upon conveniently. The chief difference between English and French papers was that the former were sized with gelatine, the latter with starch. Gelatine resisted the wax and rendered the paper less sensitive. English paper was therefore more suitable for the calotype–the best makes were R. Turner's 'Chafford Mills' and J. Whatman's 'Turkey Mill'–whilst the thinner French papers, Rive and Canson frères, and the German 'Papier Saxe', manufactured at Leipzig and Frankfurt on Main, were preferred for Le Gray's process.

The popularity which the waxed-paper process enjoyed in Britain can be gauged from the fact that the majority of the landscapes exhibited at the Society of Arts in 1852 were executed by it, whereas all the portraits had been taken on collodion. Roger Fenton and (Sir) William Crookes were among its staunchest supporters, the Pl 82 former employing it on his photographic tour to Kiev, St Petersburg, and Moscow in the summer of 1852, the latter adapting it for use at the Radcliffe Observatory in Oxford.

One of the finest exponents of the waxed-paper process in Britain was DR THOMAS KEITH, an Edinburgh surgeon. Unlike his friend D. O. Hill, Dr Keith concentrated Pls 85, 86 almost exclusively on the architecture of Edinburgh and the surrounding countryside, and in that field he was as outstanding, both technically and artistically, as Hill and Adamson in theirs. Keith ascribed his success to the fact that he never made an exposure unless the light was first-rate, and consequently he limited the time for photography to a few weeks in the middle of the summer, while on account of his professional duties most of his pictures were taken before seven in the morning or after four in the afternoon. 'The light is then much softer, the shadows are longer, and the half tints in your picture are more perfect and the lights more agreeable.' Unfortunately Dr Keith's devotion to his profession forced him to give up his hobby after about four years (1856).

Cameras for the paper processes. As the paper processes were chiefly used for landscapes and architecture, a number of ingenious cameras were devised with the object of reducing the bulk of the equipment necessary for photographic excursions. **RICHARD WILLATS** of London showed at the Great Exhibition a light-weight collapsible camera of novel design fitted with a conical expanding cloth body. Though designed for pictures of large size (10½ in. × 8½ in.) it was only 4 in. deep when packed up. The back of the camera was mounted on a sliding plate which could be clamped to the base-board at any distance from the lens, so that lenses of different focal length could be used. Fig 20

About the same time (1850) **MARCUS SPARLING**, Roger Fenton's assistant during the Crimean War, designed for Major Halkett the prototype of the magazine camera, which was extensively employed by amateurs in the army. In Sparling's camera ten sheets of sensitized paper could be stored in separate holders in a sort of magazine, and after exposure each sheet was dropped into a receptacle underneath the camera.

GEORGE STOKES devised a similar camera in 1853, which allowed twelve to twenty calotype pictures (each placed between two sheets of blotting paper) to be taken in succession. This apparatus was manufactured by T. E. Merritt.

Pride of place for ingenuity must go to **A. J. MELHUISH** and **J. B. SPENCER**, who in May 1854 patented an arrangement of carrying sensitive material (waxed paper) wound on a spool. Their roll-holder was made in several sizes, the largest taking twelve pictures 12 in. × 15 in., and Prince Albert showed great interest in the novelty when the inventors demonstrated it to him in April 1856. A camera incorporating this device was used by Frank Haes for photographing animals at the Zoo in 1855 and 1856.

Another early and apparently independent roller-slide inventor was **CAPTAIN H. J. BARR** of the Indian Service, who described his system in a communication to the Photographic Society of Bombay.[45] Barr fixed sheets of prepared paper on a band of black calico, leaving a space of about 2 in. between each paper. The band was then rolled up onto one spool and unwound onto another in the usual way. After exposure the pictures were taken off the band and developed singly; whilst in Melhuish's and Spencer's arrangement the paper roll had to be marked for each picture and cut up for development.

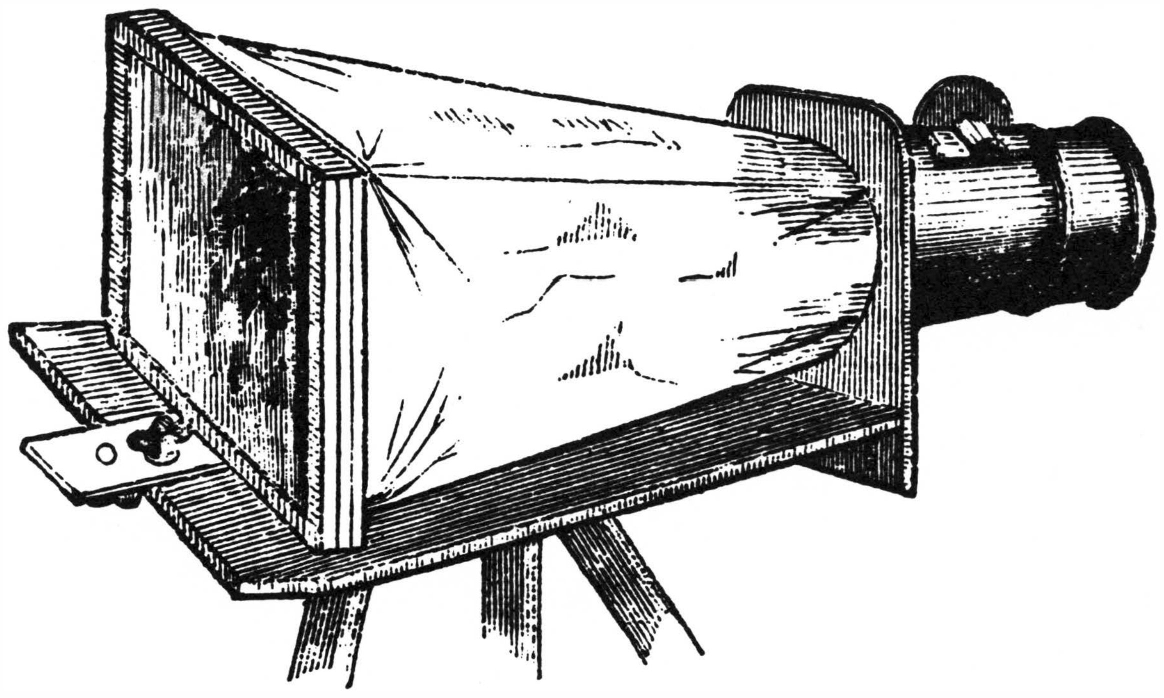


Fig 20 Richard Willats's folding camera, 1851

The price of photographic equipment had been greatly reduced by 1850. Willats sold cameras fitted with single achromatic lenses and focusing screw for as little as 35*s*. Better cameras were £3 10*s*. 0*d*.; the most expensive camera fitted with a superior double combination lens cost 6 guineas. Another dealer, J. J. Griffin & Co., in 1852 sold complete outfits, packed in a travelling case, including camera with single achromatic lens, printing-frame, chemicals, dishes, weights and measures, etc., at from 6½ guineas to 10 guineas according to the size of the camera. Fitted with double combination lenses the prices were 2 guineas to 10 guineas extra according to the quality of the lens.

In chemicals, the biggest reductions in prices occurred with the hypo fixing salt and gallic acid. The former had been reduced from 8*s*. per lb. in 1840 to 3*s*. ten years later; gallic acid dropped from 10*s*. per oz. in 1845 to 3*s*. 6*d*. five years later. The prices of other chemicals used in the calotype process were, in 1850: nitrate of silver 5*s*. per oz., iodide of potassium 1*s*. 6*d*. per oz. (it had been 3*s*. per oz. in 1845).

Paper was cheap in comparison with daguerreotype plates. In 1852 iodized paper, size 9 in. × 11 in., cost 12*s*. per quire (24 sheets); waxed paper, 9 in. × 11 in., 7*s*. 6*d*. per quire, and iodized waxed paper, 9 in. × 11 in., 12*s*. 6*d*. per quire. There were great variations in price between the different suppliers.

Though photography on paper was only slowly taken up on the Continent, and did not establish itself in America at all, the popularity which it eventually enjoyed in France and Britain shows how misinformed certain historians are about it. The late Georges Potonniée wrote in 1925: 'Talbot's process never succeeded. A few photographers who employed his process were disappointed; the manipulations were difficult, the result uncertain, and the image unsatisfactory. The process was given up.'[46] The beautiful calotypes of Hill and Adamson alone are sufficient proof that this is quite untrue. Seventy years earlier the first President of the Société Française de Photographie, Eugène Durieu, had stated: 'The future of photography lies in paper.'[47] If, however, Potonniée discounted Talbot's original process because it was improved by other experimenters, then this is equally true of the daguerreotype as first published by Daguerre.

It is still more astonishing that a German publication celebrating the centenary of photography[48] ignored Talbot's invention altogether. Yet it was Talbot who laid the foundation of present-day photography with his negative/positive process.

15 The progress of photography on paper in other countries

The Calotype in Germany. Except in France, photography on paper did not gain popularity on the Continent. Despite a manual published in Aachen in 1841 and DR F. A. W. NETTO's brochure *Die Kalotypische Portraitirkunst*, Quedlinburg and Leipzig, 1842, the practical introduction of calotype portraiture into Germany appears to be due to WILHELM BREUNING, an actor turned daguerreotypist. He announced in the *Hamburger Nachrichten* on 22 July 1846 that by unceasing experimentation he had at last succeeded in bringing to perfection a 'hitherto unknown process called "Kalotypiren"'. From now on, the advertisement continued, he would take portraits by Daguerre's and Talbot's processes, praising the many advantages of photographs on paper in glowing terms. Breuning was five weeks before Biow in practising calotype portraiture in Germany.

On 28 August 1846 HERMANN BIOW, the Hamburg daguerreotypist, announced in the same newspaper that he would in future practise both daguerreotype and calotype portraiture. He laid particular stress on the fact that the paper portraits could not be rubbed off and therefore did not require a protective glass; that they could be stuck in an album like prints, and be sent in letters; that they looked like drawings and avoided the exaggerated sharpness of the daguerreotype. Finally, once a portrait had been taken, Biow pointed out, people could obtain equally good copies many years later–much to the consolation of absent friends and bereaved persons.[1] In spite of these efforts, talbotype portraiture appears to have gained no real foothold in Germany. On the other hand, the paper process did win favour for landscapes and architectural studies, on account of its portability and the comparative ease with Pl 84
which large pictures could be obtained.

ALOÏS LÖCHERER, originally a pharmacist, was, with Franz Hanfstaengl and Joseph Albert, one of the leading Munich photographers of the early period. He had learned daguerreotyping in 1840, probably from Isenring, and changed over to the paper process seven years later. 'Löcherer's portraits on paper appear without any defect. They are executed with a fine artistic taste and with due observation of the character of the person whose portrait is to be taken.'[2] Though specializing in portraiture–he published fifteen portraits of celebrities in *Photographisches Album der Zeitgenossen*–
Löcherer is best known for his calotypes of the transport of the several parts of the Pl 88
60-ft high bronze statue 'Bavaria' from the foundry to its position in front of the Hall of Fame (Ruhmeshalle) in Munich. This series taken in 1850 was probably the

earliest photo-reportage of an event ever undertaken, showing the workmen–though of necessity posed–taking up positions natural for their work.

Löcherer also made *genre* and nude studies, and in 1855 published 50 reproductions of fifteenth- and sixteenth-century engravings in the Bavarian royal collection. Two years earlier he had changed over to the collodion process.

FRANZ HANFSTAENGL, founder in 1834 of the still existing art publishers in Munich, changed over from lithographic to photographic reproductions in 1853 and Pl 87 started at the same time a studio where he calotyped many well-known people. At the big industrial exhibition in Munich the following year at the Glaspalast, Hanfstaengl and Löcherer were prominent in the Creative Art section in which photographs were shown on equality with paintings. Hanfstaengl is said to have introduced the retouching of negatives and made a display of these at the Universal Exhibition, Paris, 1855, showing proofs before and after retouching the negative. The Hanfstaengls were quite a prominent family in photography. Erwin and Teich became Court photographer in Paris and Dresden respectively, both during the carte-de-visite period.

Several German amateurs used the waxed-paper process for its convenience when travelling. A. F. OPPENHEIM of Dresden learned the waxed-paper process from its inventor Le Gray and used it on a tour of Spain in 1852, and the following year for a large number of photographs of the Athenean Acropolis–general views and details. An album of 42 waxed-paper photographs 34 cm. × 26 cm. was published by Oppenheim in 1854.

DR AUGUST JAKOB LORENT became noted for his waxed-paper photographs in the late 1850s. In 1861 he published a volume of 112 photographs of Egypt, Spain, Algeria and other Mediterranean countries taken between 1852–60. This was followed by similar works on Sicily and Jerusalem where as late as 1864 he was still using waxed paper.

Lastly we should mention AUGUST SALZMANN, a painter born in Constance, whose two-volume work *Jerusalem, Études et Réproductions photographiques de la Ville Sainte* contains 180 calotypes 46 cm. × 62 cm. taken during his six months' stay there. They were printed at Blanquart-Evrard's Lille establishment and published in Paris 1855–56.

The calotype in Austria. In Austria the first calotype studio was opened by the portrait painters R. GAUPMANN and G. FISCHER in Vienna, in October 1847. In recommending the novel form of portraiture to its readers, the *Wiener Allgemeine Theaterzeitung* mentions that Talbot's process had not yet gained the general recognition which it deserved, nor were its many advantages over the daguerreotype sufficently appreciated, especially as regards its application to portraiture. The article stressed the facility talbotypes afforded to artists to improve the artistic effect of their pictures by toning down or removing anything unattractive, like wrinkles, which may have been reproduced with too great accuracy. The whole report was at once reprinted verbatim in a Berlin paper[3]–a further proof that calotype portraiture was unknown there also.

The calotype in Scandinavia. The only professional calotypist in Scandinavia was a Danish-born lawyer, HANS THØGER WINTHER, who had a portrait studio in Stockholm for a few months in 1842 before settling in Oslo, where he published a manual in 1845.

The calotype in America. In America the daguerreotype reigned supreme, and it therefore comes as a surprise that Talbot thought it worth while to patent his invention there (26 June 1847)–six and a half years after he had patented it in England.

Still stranger is the fact that two leading professional portrait daguerreotypists in Philadelphia, the brothers WILLIAM and FREDERICK LANGENHEIM, with their experience of American conditions, were induced to purchase Talbot's United States patent in May 1849, for 6,000 dollars, speculating to sell individual licences including their own improvements at 30 dollars each for the first two hundred sold, and at 50 dollars thereafter. They hopefully distributed a thousand circulars all over the United States detailing the advantages of photography on paper, but did not succeed in selling a single licence. The Langenheims remained the only professionals, practising for a time what they preached. The few amateurs who had experimented with the process long before it was patented naturally saw no reason why they should suddenly have to pay for what they had been free to practise for years. In the circumstances the Langenheims were unable to pay their remaining instalments to Talbot and offered him instead the patent rights for 'their' albumen-on-glass manipulation. Talbot's refusal contributed to the bankruptcy of the Langenheims' firm in 1851.

The calotype in France. Discussion of the position of photography on paper in France has been purposely left to the last, for the progress it was to make there after 1847 directly influenced the course of photography in Britain.

In May 1843 Talbot went to Paris for the purpose of introducing the calotype, which had been patented in France on 20 August 1841.[4] He demonstrated the process in the presence of several members of the Institut de France, and gave public lectures on it for a week or two in a large room in the Hôtel de Nantes (which used to stand in the Place du Carrousel). Yet despite these efforts, the calotype failed to arouse greater enthusiasm than Bayard's paper process, and we hear of only one French licence, sold to the Marquis de Bassano in 1844.

Though the daguerreotype solely occupied the attention of the French in the early and mid-1840s, it gradually came to be realized that the mirror-like character of the silvered plate was incompatible with a really artistic effect. Artists and people of taste from time to time expressed their preference for the calotype, but Talbot's instructions were not generally available in France, and people were confused by the many new 'types' emanating from Britain, which were always supposed to be improvements on the original process, but failed to give reliable results when put to the test. This uncertainty was discouraging, and photography on paper remained stationary in France, as elsewhere, until 1847.

BLANQUART-EVRARD'S PROCESS

On 25 January of that year LOUIS-DÉSIRÉ BLANQUART-EVRARD, a cloth merchant of Lille who had learned the calotype process from a local chemist named Tanner in 1844, submitted to the Académie des Sciences some paper photographs which were considered greatly superior to any so far seen in France. He was invited to demonstrate his method before a joint committee of the Académie des Sciences and the Académie des Beaux-Arts, and a thorough examination lasting three days was made at the Collège de France in April.

In submitting his process Blanquart-Evrard had omitted to mention that it was a modification of the calotype, and this naturally infuriated Talbot, who complained bitterly of 'this glaring act of scientific piracy' to the British Association meeting at Oxford in June. However, the joint committee reporting to the Académie des Beaux-Arts on 19 June repaired Blanquart-Evrard's omission, admitting that the difference between the two processes lay merely in the manipulation, nevertheless, they found the new method much more reliable than Talbot's, especially in its application to portraiture.

In the calotype process, the light-sensitive substances were coated on the *surface* of the paper, resulting in negatives which were too contrasty and lacking in half-tones. Blanquart-Evrard, on the other hand, floated his paper on two successive baths of iodide of potassium and nitrate of silver (reversing the procedure of Talbot). By this means the paper was thoroughly *impregnated* and consequently gave a much greater gradation of tone and detail. The sensitized paper could be kept for several months, but before use it had to be damped with an acid solution of nitrate of silver and exposed–backed with moist paper–between two thin glass plates. Gallic acid was only used for developing, not in sensitizing as in the calotype, and exposures were reduced to about one-quarter of that necessary for a calotype or a daguerreotype.

A drawback of Blanquart-Evrard's method was that the final preparation requiring to be carried out immediately before exposure, necessitated the transportation of a dark-tent and chemicals, and this offset to a certain degree the advantages gained. Three years later he therefore suggested a further modification, namely, a dry negative paper prepared with whey and white of egg as a support for the silver salts; this was slower but could be prepared beforehand, thus 'freeing the operator from the difficult preparations which he has to make at the places of exposure'.[5]

The publication of Blanquart-Evrard's wet process 'marked the beginning of a new era for photography on paper'.[6] Baron Gros, as already mentioned in chapter 10, foresaw that the daguerreotype had almost run its course, and that its rival on paper was destined to supersede it.[7]

The enthusiasm with which Blanquart-Evrard's process was greeted gave him the idea of exploiting it commercially for the large-scale printing of positives from amateurs' negatives and for book illustration, just as Talbot had done at the Reading establishment, and in July 1851 he opened such a printing firm at the estate of his his friend and partner Hippolyte Fockedey, on the outskirts of Lille. It was on a much larger scale than the Reading establishment had been. The work was carried out by forty girls who divided their time between photography and agriculture, according to the amount of printing to be done. In the organization of the various departments the Lille establishment can be counted as the forerunner of similar modern firms. Everything was scientifically planned in rooms in which the temperature was maintained at 70° F. The printing-paper having meanwhile been further modified contained gelatine, and iodide and bromide of potassium. After fuming over dilute hydrochloric acid, it was sensitized in the nitrate of silver bath. Immediately it was dry the paper was put in a printing-frame which ran on wheels upon a pair of rails up to a shuttered window in a darkroom, the shutter being raised for the requisite number of seconds. The printing frame was then taken to the developing room where a number of girls at a row of benches developed the prints in large dishes, several at a time, in a saturated solution of gallic acid for about 20 minutes. Developing positive prints like negatives shortened the exposure to a few seconds and allowed them to be turned out on a mass production scale. In this procedure, originally suggested by Talbot for calotype prints but soon abandoned, Blanquart-Evrard was very much ahead of his time, for it only came into general practice with gelatine papers. Printing with albumen paper was a very slow printing-out method, as will be seen in chapter 29. Blanquart-Evrard claimed in 1851 that as many as 200 to 300 copies could be printed from one negative per day, and hence they could be sold at 5 to 15 centimes according to size.[7] THOMAS SUTTON, who was associated with Blanquart-Evrard from 1855 to 1857, mentions[8] that he saw 250 prints made from one of his own negatives in less than 2 hours, and notes that in general the exposure varied between 2 and 20 seconds according to the light and the density of the negative.

As it was well known that talbotype prints were apt to fade, the greatest care was taken to secure permanence in the prints made at Lille. This was achieved by putting the prints through two hypo baths, and toning them with chloride of gold; the prints were then rinsed for some hours, with periodical changes of water. Finally they were dried in sunlight, and at this stage their reddish-brown colour changed to a dark grey.

Blanquart-Evrard turned out a surprisingly large number of publications illustrated with views from nature and reproductions of paintings, sculpture, and engravings, and many talented amateurs and professionals worked for him. His first publication illustrated with photographs was *Album photographique de l'artiste et de l'amateur* (September 1851). It was followed by *Mélange photographique*; *Études de paysages*; *L'Art Chrétien*, and many others.

The first French photographically illustrated publications were two little guidebooks on Bellevue and Chantilly by L. A. Martin, which despite the title *Promenades poétiques et daguerriennes* were illustrated with seven and six *paper* photographs respectively. They appeared in 1850. They were followed by the first part of *Italie monumentale* by Eugène Piot, which started publication in May 1851. Later that year appeared Henri Le Secq's *Amiens: Recueil de Photographies* and Maxime Du Camp's *Égypte, Nubie, Palestine et Syrie*, which is one of the best-known French publications illustrated with original photographs. MAXIME DU CAMP made an archaeological expedition to the Near East under the auspices of the Ministry of Education, leaving France at the beginning of November 1849 accompanied by the novelist Gustave Flaubert.

During this tour Du Camp used the calotype process as modified by Blanquart-Evrard, and after his return in 1851 published a selection of 125 photographs, (out of 220 taken) with short descriptions.[9] The size of the edition is not known but far exceeded the 25 copies stated by Stenger, for the book is not particularly rare. A narrative of the tour was published separately but without illustrations, in 1853. The prints, which were made at Lille, bear out Blanquart-Evrard's claim for permanence. They have preserved their cold dark grey colour to this day, but most of the prints are too dark and lacking in contrast. This is due to the *sel d'or* toning which weakened the strength of the prints, necessitating a considerable over-exposure which was difficult to judge. Neither the colour nor the quality of the prints can compare in beauty with the warm reddish-brown colour of the calotype prints produced by Hill and Adamson. Pl 89

Ever since Napoleon dreamed of an Eastern Empire, Frenchmen were fascinated by these lands of ancient civilization and their associations with early Christianity. Few could visit them, but everyone wanted to know more about them. Though several daguerreotypists had brought back pictures from the Near East in the early 1840s, Maxime Du Camp's were the first that could be published as actual photographs. They were soon to be followed by numerous French and English books of a similar character, for by this time the Near East had become the Grand Tour of the nineteenth century rich.

A great exponent of the wet calotype process was Comte F. FLACHÉRON, who was the centre of a small photographic circle in Rome in 1850–2, to which belonged Prince Giron des Anglonnes, Signor Caneva, Eugène Constant, and a Mr Robinson. R. W. Thomas, a photographic wholesaler in London, spoke very highly of their work, and described as a warning to intending travellers his own complete failure with the ordinary calotype in Rome, saying that the wet method far excelled any other in hot climates.[10]

THE WAXED-PAPER PROCESS

It was another Frenchman, GUSTAVE LE GRAY, who brought photography on paper to its culmination in the 1850s with the waxed-paper process. A struggling young artist with a family to support, Le Gray abandoned painting for photography around 1848, and with the financial backing of the Comte de Briges opened a portrait studio on the top floor of the same house as the Bisson brothers, in the Madeleine district. His reputation, however, was made not in the field of portraiture but as an architectural and landscape photographer. He also taught photography and 'nearly all renowned photographers of the day have been his pupils'. Le Gray devoted a good deal of time to experiments and wrote a number of manuals. His invention of the waxed-paper process dates back to before 25 February 1851, but the manipulation was not published until the following December.[11] All during that summer Le Gray and two of his friends had been working with waxed paper on a photographic tour of the provinces for the Committee of Historic Monuments. The waxed-paper process was far more than a mere modification of the calotype, as can be seen from the substances used in iodizing the paper–rice water, sugar of milk, iodide of potassium, cyanide of potassium, fluoride of potassium (to which was later added white honey and the white of one egg). Sensitizing was done with an acid solution of nitrate of silver and development took place with gallic acid.

The process took its name from the fact that the paper was waxed *before* iodizing, instead of merely after exposure, to facilitate printing. The wax filled the pores of the paper and made it more transparent. It proved ideal for the travelling photographer, because the paper could be prepared ten to fourteen days beforehand (instead of the day before as with the calotype) and did not need to be developed until several days after the picture had been taken (whereas the calotype had to be developed the same day). Exposures were, on the whole, about the same as with the calotype, but development took 1 to 3 hours. Le Gray's method immediately superseded all other paper processes for landscapes and architecture, for besides the advantages mentioned, a waxed-paper negative is characterized by almost as fine detail as a glass negative.

The Société Héliographique. The widespread popularity which photography on paper had won among amateurs in France led to a desire for the formation of a photographic society, which was founded in January 1851 by Colonel B. R. de Montfort. The SOCIÉTÉ HÉLIOGRAPHIQUE had its headquarters at Colonel de Montfort's house at 15 Rue de l'Arcade in the centre of fashionable Paris. A suite of four or five rooms with an extensive roof-garden was devoted to the photographic pursuits of the members, and the proceedings were reported in *La Lumière*. It first appeared as a weekly on 9 February 1851 and continued regularly until the end of 1860, but whereas the Société Héliographique was the first photographic society in the world, *La Lumière* had been preceded by *The Daguerreian Journal* (first issue, 1 November 1850) and by *The Photographic Art Journal* (first issue, January 1851), both of them published in New York.

The President of the Society was Baron Gros, and many of its forty members were men famous in photography, science, and art: Édouard Baldus, Hippolyte Bayard, Henri Le Secq, Gustave Le Gray, Charles Nègre, Abel Niépce de Saint-Victor, Eugène Durieu, Benjamin Delessert, O. Mestral, the scientists Edmond

Becquerel and H. V. Regnault, the painter Eugène Delacroix, the writers Champfleury and Francis Wey, the engraver A. F. Lemaître, and the optical instrument makers Charles Chevalier and N. P. Lerebours. In addition to its founder and president, the Society had a good sprinkling of aristocrats: Comte Olympe Aguado, Comte L. de Laborde, Comte de Haussonville, Prince de Montléart, Baron de Montesquieu, and Vicomte Vigier.

Acting on the advice of Francis Wey, who had urged the Académie des Beaux-Arts to publish a series of photographs of French historic monuments, a number of photographers were commisioned and allotted different districts during the summers of 1851 and 1852. Gustave Le Gray and O. Mestral covered Touraine and Aquitaine, and Henri Le Secq Champagne and Alsace Lorraine, all three using the still secret waxed-paper process. É. Baldus, working with the calotype process, photographed the principal monuments in Paris, Fontainebleau, Burgundy and the Dauphiné; Hippolyte Bayard worked in Normandy using albumen-on-glass plates. To the general dismay, the Comité des Monuments Historiques did not publish the photographs but stored them instead under lock and key, a procedure not uncommon amongst antiquaries. They are still preserved in the architectural department of the Archives at the Beaux-Arts.

ÉDOUARD BALDUS, born in Westphalia, was a naturalized Frenchman. Originally a painter, he became one of the leading French architectural photographers of the early period, producing very large (13½ in. × 17½ in.) calotypes and gelatine paper photographs–a variation of the waxed-paper process which he recommended in May 1852,[12] and to which the *finesse* and quality of the latter were attributed. Apart from his work for the Comité des Monuments Historiques referred to, he photographed in 1853 monuments in Arles, Nîmes and Avignon. In 1854-55 he made for the Government a complete survey of the new wing of the Louvre in 1,500 detail photographs $\frac{1}{10}$ the size of the original subjects: acanthus leaves on capitals, garlands, statues. Every detail was reproduced separately–a very modern approach compared with the general views usually taken in those days, and some prints were of exceptional size, 44 cm. × 58 cm. (17½ in. × 23 in.). Together with Marville and Bayard, Baldus was commissioned to photograph the sculpture collections at the Louvre and Versailles. He also specialized in the reproduction of paintings. Less known are his albums of views of architecture and landscape between Calais and Paris on the route taken by Queen Victoria and Prince Albert during their State visit in August 1855, and the new railway from Paris to Marseilles inaugurated by the Emperor Napoleon III in the same year. Copies of these albums were presented by the respective railway companies to the sovereigns. About 1856 Baldus changed over to the collodion process. Pl 91

HENRI LE SECQ was also a painter and photographer. His photo-surveys of the cathedrals of Chartres, Rheims, Amiens, Beauvais and Strasbourg, with details of the statues on the façades, are of great historical interest, showing the cathedrals before their restoration by Viollet-le-Duc. Apart from his architectural work Le Secq also excelled in landscapes, which were compared by his contemporaries to the paintings of Corot and Théodore Rousseau. A few years later he also became well known for art reproductions. Many of Le Secq's photographs appeared in Blanquart-Evrard's publications. Pl 90

In the 1850s CHARLES MARVILLE, another painter-photographer, made a unique documentation of those Parisian districts which were shortly to fall victim to Haussmann's grandiose layout.[13] Apart from this documentation of Paris, Marville seems to have worked for a number of years for Blanquart-Evrard, whose modification of the calotype process he used. Several of the Lille publications are illustrated with Marville's photographs, such as the series *L'Art Réligieux*, *Études et Paysages*, and others.

CHARLES NÈGRE was a pupil of Delaroche and Ingres. Together with Le Secq he took lessons in the waxed-paper process from Gustave Le Gray early in 1851, primarily in order to make studies for his Salon paintings, mainly *genre* subjects, which are faithful copies of his photographs. The first photograph we hear of, taken in April or May 1851, shows a rag collector strongly lit up by a lantern. The following spring Nègre showed two paintings at the Salon, *The Death of Abel* and *Les Tireurs d'arc*, but as the two pictures apparently no longer exist we can only guess at the extent of photography's role in them from a review of the Salon by the art critic Henri de Lacretelle. 'Today M. Nègre is classed among the best landscapists, those who dramatize nature as Salvator (Rosa) did. These last two paintings are a new proof that the photographic work completes and strengthens the painter.'[14]

Pl 93 *Les Ramoneurs*, exhibited in May 1852, led one enthusiastic critic to a comparison with the drawings of Rembrandt: to another it recalled Murillo. Even if these comparisons were meaningless, they do prove the great impact of Nègre's *genre* photographs, of which he was the first exponent in France. Another well-known photograph and Salon painting depicted a street organ-grinder and his audience of two children. The painting was shown at the Salon of 1853.

Though not commissioned by the Comité des Monuments Historiques, Nègre in the summer of 1851 took a series of photographs of Chartres cathedral by the waxed-paper process. His 52 cm. × 74 cm. (20½ in. × 29 in.) paper negatives are the largest known.

The following year Nègre brought back 200 waxed-paper photographs from a photographic tour in Provence. Sixty of them were published in five parts of twelve each.[15] The prints for this publication were made by H. de Fonteny's Imprimerie Photographique, a rival firm whose prints were not so permanent as Blanquart-Evrard's.

In 1860 Nègre made a documentation of the Asyl de Vincennes for convalescing old workers, using the collodion process to which he had changed seven years earlier.

Distinguished amateurs working with either Talbot's, Blanquart-Evrard's or Le Pl 96 Gray's process were Baron Humbert de Molard, Vicomte Vigier, Henri Victor Regnault the physicist, Louis Alphonse Davanne the chemist, and above all CHARLES VICTOR HUGO and his brother FRANCOIS, sons of the novelist and poet Victor Hugo. After the *coup d'état* of the Prince-President Louis Napoleon on 2 December 1851 Victor Hugo, a Republican member of the Legislative Assembly, lived in exile in Jersey (and from 1855 on in Guernsey) with his family and the poet Auguste Vacquerie. He did not return to Paris until the establishment of the Third Republic in September 1870. For his sons, photography had the novelty of an enjoyable recreation during the first year or so on Jersey. They produced a remarkable documentation of their life at Marine Terrace, St Helier, and their surroundings on the island. They stuck their photographs in an album, which was published in Paris in August 1853, accompanied by a book containing verses and drawings by Victor Hugo, prose by Auguste Vacquerie, Charles and François Hugo, in a limited *de luxe* edition which is greatly treasured today.[16] Completely unhampered by preconceived ideas, the photographs of Charles and François Hugo possess originality and at the same time the naïve charm of family snapshots: in short, a quality of their own which places them quite apart from the self-conscious attempts of other amateurs ambitious to compose beautiful landscapes or artistic portraits. The Hugo brothers display a sensitive and imaginative outlook. They portrayed the sleeping cat 'Mouche', show us the gnarled logs of the breakwater on the beach, the sunlit cosy corner in the conservatory under the flowering vines, Victor Hugo perched on 'the rock of the exiles'–pictures which greatly impressed Ernest Lacan who wrote 'The photographers Charles and François Hugo have won the right to be classed in the front rank of those active in this field.'[17]

16 *The introduction of photography on glass*

THE ALBUMEN PROCESS 1848–*c.* 1857

It is surprising that the first practical photographic process on glass was introduced as late as 1848, for glass had the advantage of being a cheaper base for the sensitive coating than a silvered copper plate, as well as being free from the defects which marred the paper processes. Its transparency made it the perfect base for the multiplication of copies, and but for its weight and fragility it would have established itself as the ideal carrier of photographic emulsions. The chief problem in devising a practical process on glass was to find a vehicle for the silver salts which would not dissolve or float off during development, fixing, and rinsing.

The use of glass for photographic purposes was not novel. It will be remembered that Nicéphore Niépce had used it for two views before 1829, and Daguerre also made some 'sketches upon glass' which he considered to have 'more charm, and, above all, much greater delicacy' than pictures on metal. However, he failed to speed up Niépce's bitumen process.

SIR JOHN HERSCHEL evolved a glass process in September 1839 (see page 97), and **ROBERT HUNT** and his friend John T. Towson of Falmouth experimented with this method, which 'is capable of producing pictures of the most extreme delicacy and as we are enabled to take a number of positive copies from an original negative photograph on glass, it is a means which promises to be exceedingly valuable in forwarding the most important branch of the photographic art, namely publication'.[1] Yet in spite of Hunt's opinion, Herschel's glass process must for some reason or other have been impracticable; otherwise it is difficult to understand why it should have failed to win immediate popularity, for a good alternative to the calotype would have rendered photographers independent of Talbot's patents. (Positive copies could have been printed on Photogenic Drawing Paper, which was not patented.)

Undeterred by these apparent failures, **ABEL NIÉPCE DE SAINT-VICTOR**, a cousin of Nicéphore Niépce, continued to experiment with glass, and found eventually, after having tried starch and gelatine, that white of egg (albumen) acted as a satisfactory coating. He communicated his discovery to the Académie des Sciences on 25 October 1847,[2] but details of manipulation were not published until 12 June of the following year.[3]

In the albumen process the glass plate was coated with a thin layer of white of egg containing a few drops of a solution of iodide of potassium. When dry, the plate was washed with an acid solution of nitrate of silver, and after exposure the latent image was developed with gallic acid, and fixed in the usual way.

Though Niépce de Saint-Victor's invention was a great step forward, it had certain drawbacks which almost counterbalanced its advantage of rendering very fine detail. On account of its slowness (5 to 15 minutes' exposure, according to circumstances) its application to portraiture was precluded, but it was excellent for landscapes, architecture, and art reproductions. The exposure could be considerably reduced if the plate was exposed immediately after sensitizing, while still moist, but this entailed – at least for the travelling photographer – the irksome transport of a dark-tent and chemicals. On the other hand, with the slower dry method plates could be kept for a fortnight after sensitizing, and development could be postponed for one or two weeks after exposure.

Tediousness of preparation was another objection, for the albumen had to be prepared by the photographer himself. Directions for preparation might have been taken straight from a cookery book. Fresh eggs, the first essential, were easy to procure in those days anywhere and in any quantity, but once the white of egg was beaten to a stiff froth it had to be used up.

Talbot patented modifications of the albumen-on-glass process in December 1849 and in June 1851. He acknowledged his indebtedness to Dr Woods of Parsonstown and to Robert Hunt for the use of certain chemicals incorporated in his modifications, but not a word was said of the originator of the albumen process, Niépce de Saint-Victor. Yet four years earlier when Blanquart-Evrard freely published an adaptation of calotype, Talbot was filled with indignation at what he called 'this glaring act of scientific piracy'. Now, in an analogous situation, he found it convenient to argue that 'in the true adjustment of the proportions and in the mode of operation lies the difficulty of these investigations'.[4]

Because of its perfect transparency albumen was admirably suited for magic-lantern slides and for stereoscopic glass positives. The former were introduced by the brothers LANGENHEIM of Philadelphia in 1849 under the name of Hyalotypes[5] (Greek ὕαλος, glass); the latter by A. and C. M. FERRIER of Paris in 1851. C. M. Ferrier, whose work for the Great Exhibition has already been mentioned (see page 174), became one of the leading landscape photographers in France. His stereoscopic views of the Alps and other parts of Europe were sold in thousands, for these albumen transparencies enjoyed tremendous popularity, in conjunction with Brewster's instrument, on account of their clarity and brilliance, far surpassing photographs on paper or made by the daguerreotype, both of which had to be viewed by reflected light.

Owing to Talbot's patents, the albumen-on-glass process failed to establish itself in England. In 1855, when photographers need no longer anticipate interference from Talbot, two well-known professionals, J. E. MAYALL and HENRY NEGRETTI (of Negretti & Zambra) tried to popularize it, but by then the much faster collodion process was available, and those who found this too complicated chose the waxed-paper process, which was also more sensitive than albumen. Albumen failed to find favour with amateurs, the only notable exceptions being EUGÈNE CONSTANT and HUMBERT DE MOLARD. The latter had participated in the earliest experiments of Niépce de Saint-Victor in 1846–7, and showed portraits by his modification of the process, making it 'nearly as fast as collodion', to the Académie des Sciences in August 1850. A number of well-known professional architectural and landscape photographers used the process for a time. Leading in Britain were ROSS & THOMPSON of Edinburgh, who exhibited the first British albumen photographs, taken by a modified method of their own, at the British Association meeting in Aberdeen in 1850. Probably in deference to Talbot's patent, the albumen photographs of Ross &

Thompson and of the French photographer, **F. MARTENS**, were referred to as 'Talbotypes on glass' by the Jurors of the Great Exhibition, who praised their work in glowing terms, and bestowed on the exhibitors the highest award–the Council Medal. Of Martens's large architectural views ($9\frac{1}{2}$ in. × 12 in.) it was said, 'For richness of effect and perfection of definition they are the finest specimens which it seems possible to produce.'

HIPPOLYTE BAYARD, always ready to try something new, abandoned his own process in favour of albumen, but except for greater sharpness of definition it is difficult to detect any difference between these results and his earlier compositions–the large straw hat and picturesquely arranged flower-pots still remain favourite features in his charming garden scenes. Pl 94

The name of another claimant to the invention of photography on glass has recently been put forward,[6] but the most that can be said for **JOHANN PUCHER**, a priest of Veldes, Slovenia, is that he was an early independent worker with a glass process of his own, devised in 1842. Though one or two notices in local newspapers referred to Pucher's 'invention of producing transparent heliotypes on glass plates' in the early 1840s, his method remained unknown until 1851.[7] Johann Pucher (or, to use the Slovene version of his name, Janez Puhar) exposed his glass plates to the vapour of sulphur, and then in succession to the vapours of iodine and of mercury. As in the daguerreotype, the mercurial vapour settled on the high lights of the picture; a further development of the faint image was effected by bromine vapour, and the picture was fixed by means of alcohol.

Pucher exhibited 'Photographs on glass by a new method' in the Austrian section of the Great Exhibition, and in 1853 the French Académie Nationale, Agricole, Manufacturière et Commerciale presented him with a diploma bestowing the title 'Inventeur de la photographie sur verre'. This is the document upon which the present Yugoslav claims are based. In fact, the only French body competent at that time to judge the value of a scientific invention was the Académie des Sciences.

Pucher apparently also described in his report to the Vienna Academy in 1851 a method of making transparencies for projection by the magic lantern, but in this he was anticipated, as we have seen, by the brothers Langenheim. Of this, the Yugoslav promoters of Pucher do not appear to be aware; and, moreover, they are mistaken in thinking that Pucher's idea of magic lantern projection makes him the originator of photographic enlarging–a process serving an entirely different purpose.

Albumen paper. Albumen was found not only a convenient medium for the coating of glass negatives, but was also employed for coating positive paper. The originator of albumen paper was **BLANQUART-EVRARD**, who communicated a method of preparation to the Académie des Sciences on 27 May 1850.[8] The demand for a new paper arose from a general desire to retain the sharpness and detail of the glass negative on a smooth and glossy surface, which albumen provided. Sharp detail was unobtainable on a matt paper surface such as Talbot's, and in consequence albumen paper before long displaced the old silver chloride paper, and remained in general use until the end of the century. At first, prints on albumen paper were flat, lacking the richness of the calotype, and their ugly 'cheesy' colour was often objected to. This defect was, however, overcome by toning the prints in a solution of chloride of gold, introduced by P. E. Mathieu in 1847, which produced various shades of brown.

Albumenized positive paper could be bought ready prepared, and the consumption of eggs necessary for its manufacture is staggering. Half a million eggs were used annually by one London firm alone, at a time when the demand for carte-de-visite pictures was at its height (1862).[9] Thirty years later, after amateur snap-shooting had begun, the Albumenising Company in Dresden, then the largest manufacturer of albumen paper in Europe, used 60,000 fresh eggs daily–about eighteen million a year.[10] The yolks, which could not be used for photographic purposes, were usually sold to confectioners and leather-dressers; but a large surplus went to waste.

THE INVENTION OF THE COLLODION PROCESS

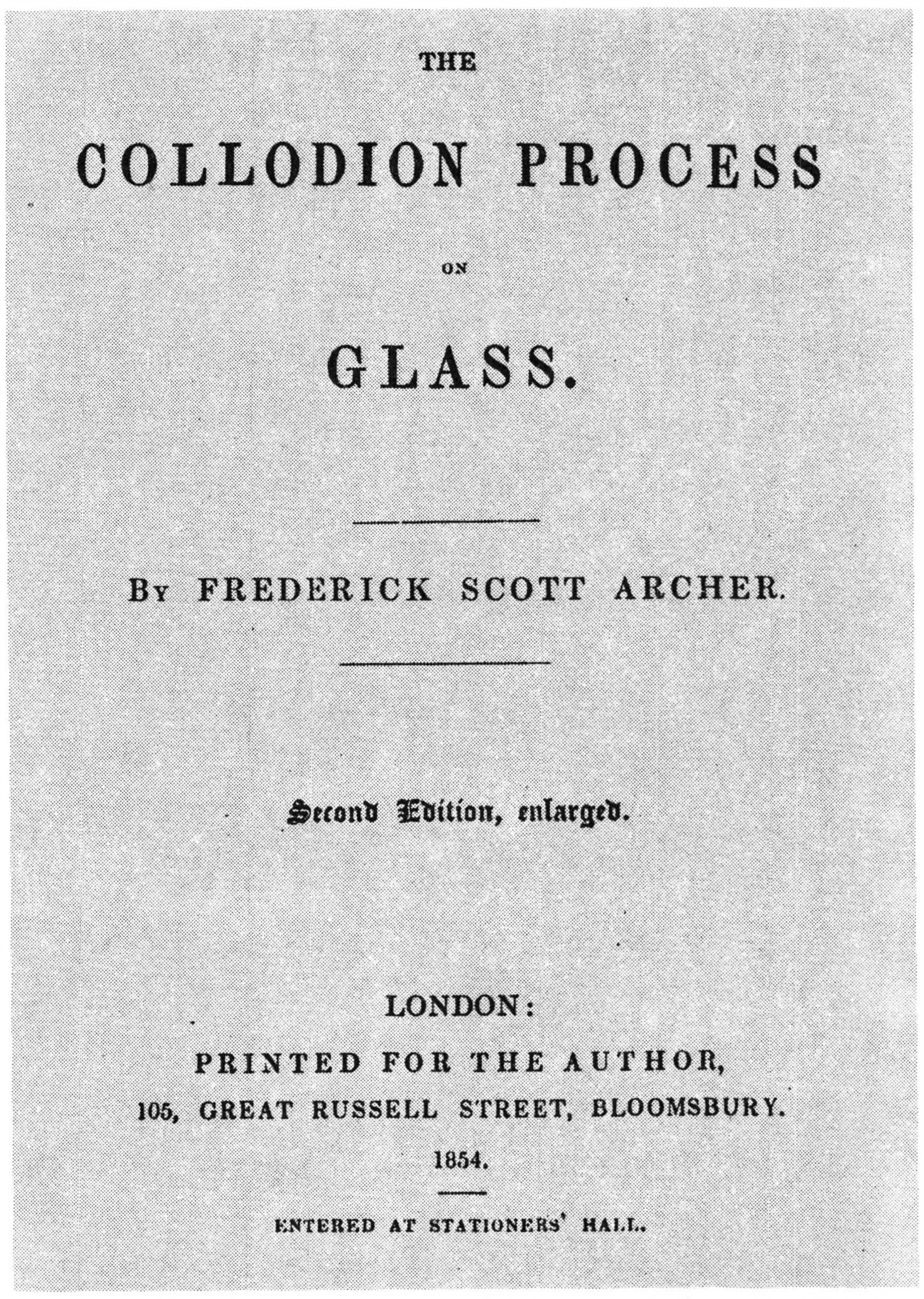
The year of Daguerre's death, 1851, marks the beginning of a new period in photography. The great invention which supplanted all existing methods–daguerreotype, calotype, and albumen–was Frederick Scott Archer's wet collodion process, introduced in March of that year. It was the fastest photographic process so far devised, and the first–in England at least–to be free from patent restrictions. Understandably, it immediately won immense popularity, to be eclipsed only by the still faster and more convenient gelatine dry plate nearly thirty years later. Up to 1880 collodion was in complete ascendancy wherever photography was practised, and to this day process-engravers all over the world use wet collodion.

Yet though his invention brought about the period of the greatest prosperity in the history of photography, FREDERICK SCOTT ARCHER–'a very inconspicuous gentleman, in poor health, with a somewhat sorrowful look and angel wife'[11]–shares the fate of another great English inventor, William Friese-Greene. Like him, he died in extreme poverty, unsweetened by fame or even recognition. Archer, the most admirable character among the inventors of photography and the very opposite of the showman Daguerre and the patent-conscious Talbot, is today almost forgotten. Pl 95

Born at Bishops Stortford, Hertfordshire, the son of a butcher, Archer lost both parents in childhood, and was brought up by distant relations and friends. While still a boy he was apprenticed to a bullion dealer and silversmith in the City of London, in whose shop he saw with delight beautiful antique gems and coins of all nations. Anxious to improve his position, Archer studied numismatics in his spare time, and eventually became a specialist as a valuer. But it was the artistic design of the coins, not their commercial value, which fascinated Archer, and when he displayed a gift for copying them by modelling (which eventually led him to try his hand at portrait busts), friends helped to set him up as a sculptor in Henrietta Street, London, where he modelled busts of many well-known people.

In November 1847 Archer learned the calotype process from Dr Hugh W. Diamond, his medical attendant, in order to obtain true likenesses of his sitters to work from. For a time Archer continued to use photography merely as an aid to sculpture, but people with an inquiring mind are tempted to probe deeper into unknown phenomena. Gradually neglecting his artistic profession, he devoted more and more time to photographic problems, until at last he was living precariously as an inventor.

Archer had for some time been experimenting with paper pulp in the hope of making an improved paper, and also with albumen, tanno-gelatine, and starch, before he was led, in the autumn of 1848, to try the effect of spreading a solution of collodion upon paper in an attempt to improve its surface. Finding that the collodion film did not adhere to the paper sufficiently well, it occurred to Archer to use collodion as a *substitute* for paper. These experiments were begun in June 1849[12] in the hope that by this means a more delicate medium than paper might be produced. Eventually he succeeded where other experimenters with collodion failed, because whereas they used it merely as a *dry base* upon which to spread the iodide of silver, analogous to the method of preparing calotype paper, Archer coated the glass plate



THE

COLLODION PROCESS

ON

GLASS.

By FREDERICK SCOTT ARCHER.

Second Edition, enlarged.

LONDON:
PRINTED FOR THE AUTHOR,
105, GREAT RUSSELL STREET, BLOOMSBURY.
1854.

ENTERED AT STATIONERS' HALL.

Fig 21 Title-page of Archer's manual, second edition, 1854

with *iodized* collodion, i.e. an emulsion of collodion containing iodide of potassium, and used it *wet*.

Before discussing Archer's rightful claim as inventor of the collodion process–a subject not hitherto fully investigated, and on which there are, in consequence, confusing statements–mention must be made that guncotton was discovered in 1846 by Professor C. F. Schönbein of Basle and introduced by him in September of the same year at the British Association meeting at Southampton. The following year Ménard and Domonte jointly discovered the solubility of guncotton in ether producing a sticky solution which they called collodion, from the Greek κόλλα, glue. As an adhesive solution, the application of collodion in surgery was first suggested in 1848 by Dr J. P. Maynard of Boston, U.S.A., who found that it had the property of covering incised wounds like a plaster.

In August of the same year Sir James Simpson recorded in *The Pharmaceutical Journal* that guncotton dissolved in sulphuric ether is reduced to a colourless gelatinous mass which, when spread upon a smooth surface, solidifies quickly by evaporation and leaves a transparent membrane which adheres with surprising tenacity and is impermeable to water. Though Simpson's observations were directed to surgical application, the properties of collodion would not go unnoticed by a photographic experimenter seeking to overcome the disadvantages of the daguerreotype and the calotype.

In May and July 1850 Archer published in *The Chemist* papers 'On the use of pyrogallic acid in photography', a more active developer than gallic acid, and of the utmost importance in the collodion process. In September 1850 he confidentially communicated details of his method, and showed pictures obtained by it, to several intimate friends, including Dr Hugh W. Diamond, but he did not publish his process until the following March, when he felt it had reached perfection.[13] Exactly a year later appeared the first edition of Archer's *Manual of the Collodion Photographic Process* which, together with the second edition, is among the greatest rarities of photographic publication in Britain.[14]

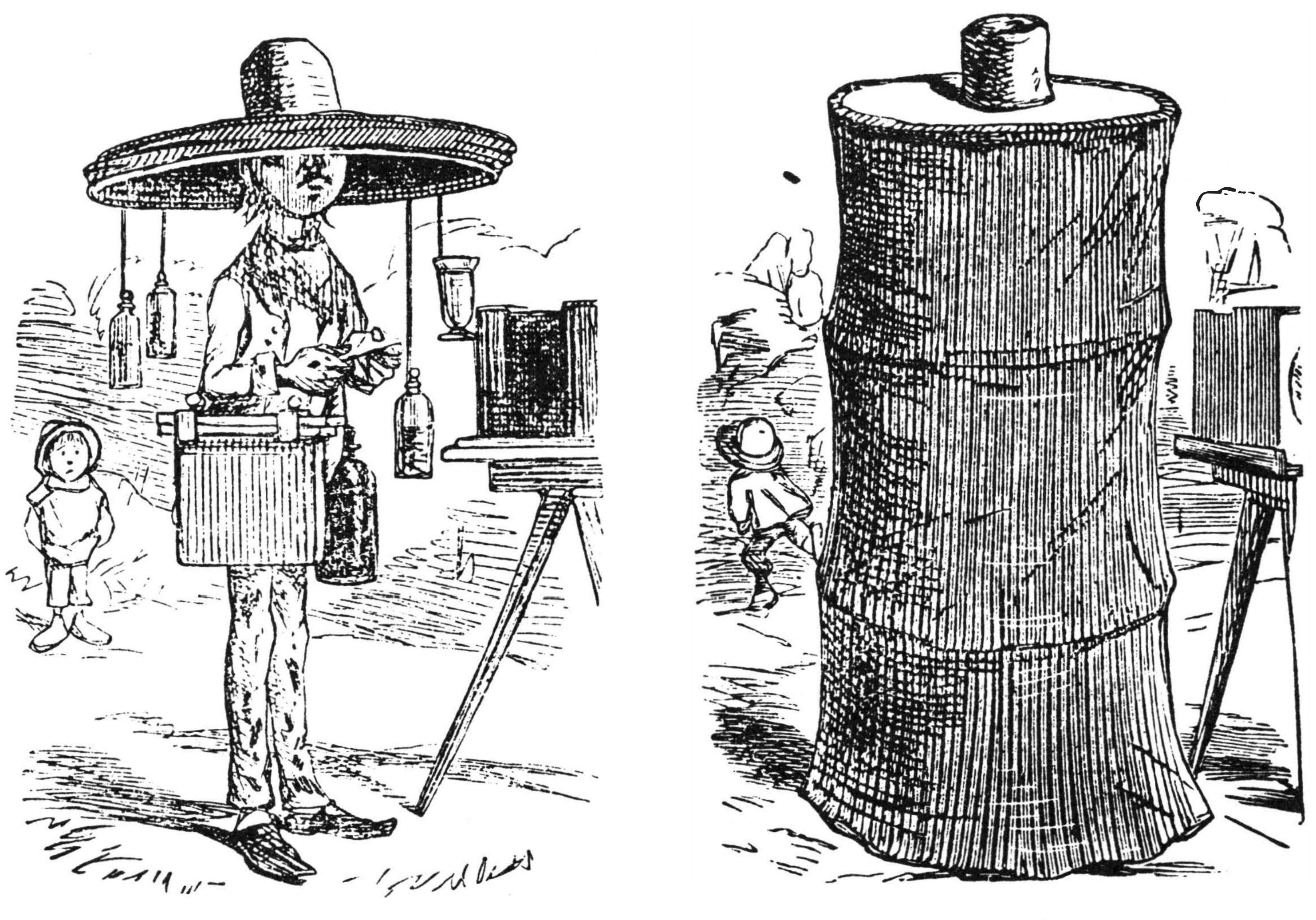
Fig 21

Collodion containing potassium iodide was poured on to the glass plate, which was tilted until the emulsion formed an even coating all over it. Sensitizing followed immediately by dipping the plate in a bath of nitrate of silver solution. It then had to be exposed while still moist, because the sensitivity deteriorated greatly as the collodion dried. Development also had to be done directly after exposure, with either pyrogallic acid or ferrous sulphate. The picture was fixed with sodium hyposulphite or potassium cyanide. As it was essential that all the manipulations be carried out while the coating on the plate was still moist (and the ether in the collodion evaporated very quickly), the collodion process is often called 'the wet-plate process'. For the travelling photographer it involved taking about a dark tent and a large quantity of chemical solutions, dishes, etc.; in fact an entire darkroom outfit. The enormous labour entailed will be described in chapter 22.

Fig 22

Archer's first results, as is usual in the infancy of a process, were not brilliant, especially in comparison with the magnificent negatives produced on albumen, which had then reached perfection. The manipulation was easier than with albumen, though far from simple, but the great advantage of collodion lay in its high degree of sensitivity. Exposures varied from 10 seconds to 1½ minutes for landscapes and architecture. Small portraits (Ambrotypes) could be taken in 2 to 20 seconds.[15] It was therefore a matter of course that collodion won immediate favour, particularly for portraiture. Portraits could either be made in the usual way with a negative, particularly when several prints were required, or the negative could be converted into an apparent positive known as 'Ambrotype' or 'collodion positive on glass'.

In July 1851 the New York photographer Edward Anthony, proprietor of one of the largest American photographic establishments, offered a reward of 500 dollars for the most valuable improvement in photography made before the close of that year. The prize was for an improvement in any branch of the art, and anyone in England, France, or Germany was free to compete with the Americans for it.[16] The awarding committee consisted of Professor Samuel Morse, Professor John W. Draper, both of



Hint for a Photographer's Tent.

Our Photographer invents a Tent.

Fig 22 Hint for a photographer's tent, cartoon from 'Punch', 1856

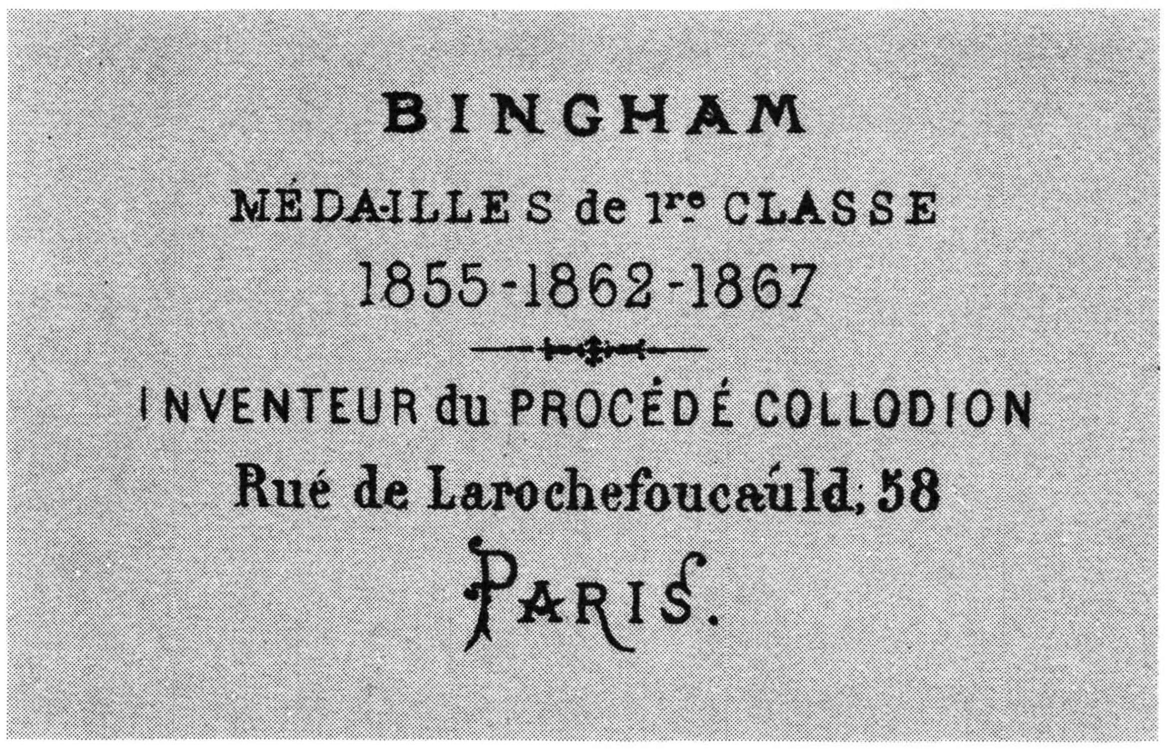
New York University, and Professor James Renwick of Columbia College. It is surprising that such a jury should have failed to appreciate Archer's invention, which was to revolutionize the photographic studios not only of Europe but of the world–and not least the donor's establishment. It is certain that had Scott Archer wished to patent the use of collodion, his profits would have been enormous.

ARCHER THE TRUE INVENTOR OF COLLODION PHOTOGRAPHY

Though the invention of the collodion process and first publication of a detailed and workable formula belong to Archer alone, the possibility of using collodion as a photographic agent had been realized by others, and soon after Archer's announcement several claimants came forward, anxious for a share in the merit of the invention. These claims have to this day somewhat obscured Archer's achievement.

It was found that prior to Archer's communication to *The Chemist* (March 1851), two other photographers had alluded to the *possible* use of collodion in photography, though without giving manipulatory details. It was not uncommon in the early days of photography, when new processes or modifications of old ones were constantly talked about, for novel ideas to be appropriated by people who had no further acquaintance with them than the name, and incorporated by them in their manuals, communications to scientific journals, and even in patents, in case they *might* become useful. The first reference to the use of collodion in photography occurs in the seventh edition of ROBERT J. BINGHAM's *Photogenic Manipulation,* published in January 1850. He lists 'collodion (gun cotton dissolved in aether)' as one of a number of substances, including gelatine and starch, which *might* be employed to form an adherent film upon glass. He writes that he has experimented with these substances and 'found them to answer moderately well' but he offers no description or manipulatory details, not even in the eleventh edition of his manual (1854) in which the paragraph is reprinted exactly as before. He had, however, communicated a collodion method to the Académie des Sciences on 11 May 1852. Despite this, he persisted in his claim to be 'Inventeur du Procédé Collodion' which was printed on the back of his photographs. Fig 23 Up to 1850 Bingham was chemical assistant in the laboratory of the London Institution, and from 1859 on portrait photographer in Paris in partnership with W. Thompson. In 1870 he made a curious death-bed statement to Thomas Sutton, claiming to have worked with Archer in his darkroom, and that Archer's publication in *The Chemist* was made without his knowledge and was in fact the process as perfected by himself, whereas Archer stated in the foreword to the second edition of his manual that he made known the collodion process '*without any assistance* [Archer's italics] from, or reference to, the labours of others in the same field of research'. It is significant that Bingham refrained from contesting Archer's claim to the invention while the latter was alive. And why did Sutton wait a further five years before publishing the 'facts'?[17] Archer's honourable character and generosity are vouched for by all who had contact with him. We need only give one contemporary opinion, which explains why Archer was so easily put upon by others. It is by John Beattie, a Bristol photographer.

> I was working hard as a daguerreotypist when I read about pictures being taken on glass by collodion. . . . It was early in August 1851. Having got Mr Archer's address, without any introduction but the simple plea of my curiosity and desire for knowledge, I called upon him. I soon found nothing more was necessary. I met a thin, pale-faced, over-thoughtful man, possessing a manner so free, unsuspicious, and gentle, that in a few minutes all idea of my being an intruder was entirely



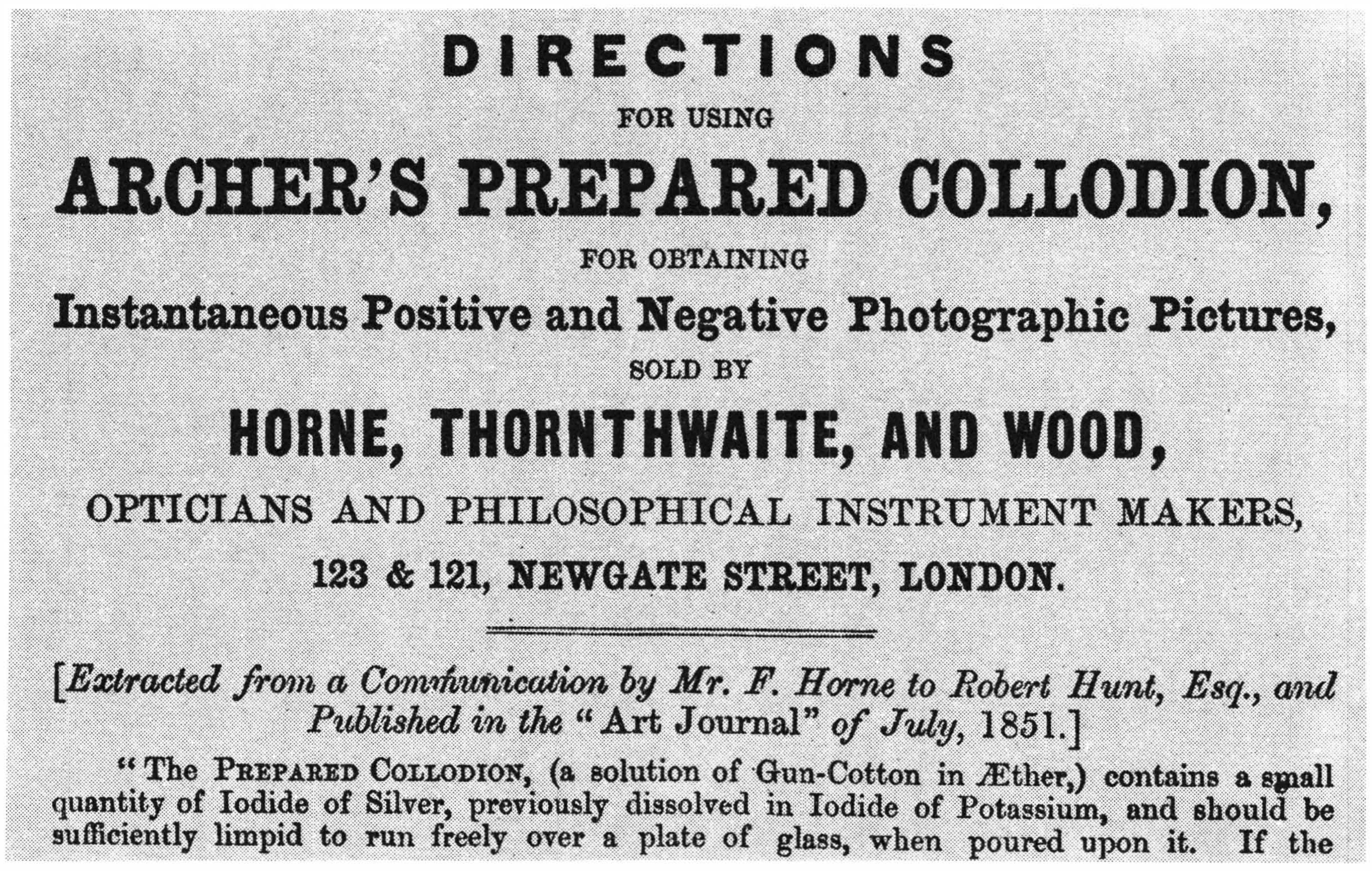
BINGHAM
MÉDAILLES de 1re CLASSE
1855-1862-1867
INVENTEUR du PROCÉDÉ COLLODION
Rué de Larochefoucaúld, 58
PARIS.

Fig 23 Back of a carte-de-visite by Robert Bingham, with his claim to be the inventor of the collodion process

> removed. . . . He was profuse in description (as if I had paid him a fee) and ended with the words, 'Perhaps you would like to see me make a picture?'. . . . But Mr Archer's generosity did not end there. He wrote me a list of chemicals which I was to procure, and told me to use his name at Horne and Thornthwaite's. . . . He shook me by the hand as warmly as if I had been obliging him. The chemists likewise made a picture for me. I left their establishment with my pockets full of bottles, but while mounting the omnibus a shower of them went into the street; and thus ended my first experiment in collodion picture making, leaving a pleasant remembrance of Mr Archer.[18]

GUSTAVE LE GRAY was the second person to allude to the possible use of collodion, in his *Traité pratique de photographie sur papier et sur verre*, Paris, June 1850.[19] Le Gray stated that he had worked out a process upon glass, using collodion. He lists some chemicals, but not their proportions, and says nothing about the manner of using them. He makes a few vague statements concerning his still incomplete experiments, by which he claims to have obtained pictures in 20 seconds in the shade, and he promises to describe his process, when successful, in an appendix. However, no such appendix was published, and in the second edition of his *Traité*, which appeared in July 1851, four months *after* Archer's communication to *The Chemist*, Le Gray merely says, 'The collodion which I indicated in my preceding brochure gives, applied to glass, very good results, more rapid than albumen. The English have put this process in practice, and succeeded perfectly in its use.' Only in the third edition (September 1852) does Le Gray give practical details, and he attempts to establish priority over Archer by stating that his experiments went back as far as 1849, when he (like Archer) tried to improve the paper surface with collodion. Contemporary French writers were unconvinced. E. de Valicourt, for instance, says[20] that the chemicals mentioned in Le Gray's first brochure could not have given an image, and this is also the opinion of Dr Eder. Archer fully acknowledged that Le Gray was the first to allude to experiments with collodion, and 'although this notice did not lead to its practical use, it establishes his claim to be considered the first to suggest its value in photography',[21] and with this fair statement any unprejudiced investigator must agree.

Peter W. Fry, a fellow-member of the Calotype Club, called on Archer soon after the publication of his process, with the request to be given instruction in the manipulation by the inventor.[22] Being more skilful than his teacher, Fry was soon able to produce pictures superior to Archer's, and in fact was the only exhibitor of a collodion photograph at the Great Exhibition. This photograph, not listed in the exhibition catalogue, was exhibited with cameras in the showcase of Horne &



DIRECTIONS
FOR USING
ARCHER'S PREPARED COLLODION,
FOR OBTAINING
Instantaneous Positive and Negative Photographic Pictures,
SOLD BY
HORNE, THORNTHWAITE, AND WOOD,
OPTICIANS AND PHILOSOPHICAL INSTRUMENT MAKERS,
123 & 121, NEWGATE STREET, LONDON.

[*Extracted from a Communication by Mr. F. Horne to Robert Hunt, Esq., and Published in the* "Art Journal" *of July*, 1851.]

"The PREPARED COLLODION, (a solution of Gun-Cotton in Æther,) contains a small quantity of Iodide of Silver, previously dissolved in Iodide of Potassium, and should be sufficiently limpid to run freely over a plate of glass, when poured upon it. If the

Fig 24 Broadsheet (detail) giving directions for making ambrotypes and collodion negatives, 1851

Thornthwaite.[23] It was a positive collodion portrait (Ambrotype) 'taken early in May 1851 by Scott Archer, assisted by Messrs Fry and Horne. Towards the end of June Mr Rippingham placed in this case some prints from negative collodion plates, the collodion having been given him by Archer.'[24] Some days before the closing of the Exhibition Archer obtained permission to show a few of his collodion negatives also.[25]

Fig 24

At the suggestion of his friend Fry, Fallon Horne was also instructed in the process by the inventor.[26] Realizing the possibilities of the process, Horne, a partner in the photographic firm of Horne & Thornthwaite, obtained from Archer the exclusive right for the sale of his iodized collodion. Immediately afterwards he sent to Robert Hunt a paper on the process[27] in which he made the ambiguous statement that 'Mr Fry was the first to practise with collodion'. This caused Hunt to couple Fry's name with Archer's in the third and fourth editions of his manual, but he retracted this error later in a letter to the Archer Fund Committee, saying that 'the misconception which surrounded the introduction of collodion has arisen from the unobtrusive character of Mr Archer himself, who deferred for a considerable period the publication of the process of which he was the discoverer'.[28]

Scott Archer came to regret now that he had not followed the advice repeatedly given to him by his friends to advertise his invention as the 'Archerotype': 'but I was unwilling to do so, not because I doubted my right to the name, but I was satisfied with the general recognition of my claims and left others to name it for me. Had I done it myself at once, the invention at this late hour would not have been claimed by another.'[29]

TALBOT CLAIMS THE COLLODION PROCESS

Archer's generosity in giving his invention free to all was indeed poorly repaid. While false claimants tried to rob Archer of the honour as inventor, Fox Talbot, seeing his monopoly endangered by the sudden popularity of collodion, tried to bring it within his grasp by putting forward the extraordinary claim that Archer's process was covered by his own calotype patent. He argued that the negatives were obtained on a film of iodized collodion spread upon glass, instead of being obtained upon a sheet of iodized paper, and that in both cases an invisible image was impressed upon a light-sensitive surface – whether collodion or paper was immaterial – which had to be developed and fixed. Talbot even issued public warnings that he would prosecute any photographer selling portraits by the collodion process without a licence from him, and timid spirits thought it wiser to take out a licence than to have their business closed. PHILIP H. DELAMOTTE, later professor of drawing at King's College, London, announced, for instance, in April 1853 that 'his arrangement with the patentee, Mr H. F. Talbot, enables him to take portraits by the newly discovered collodion process', and these he incongruously named 'calotype portraits taken by the collodion process'.[30] Archer, with his usual shyness, avoided putting forward his views on the matter.

About this time THOMAS SIMS, a professional photographer, received a letter from the squire of Lacock praising his photographs and requesting an interview. 'To have gained the commendation of Mr Tox Talbot', wrote Sims in his diary, 'might mean the first steps to fortune.' Sims hastened to the meeting, but found awaiting him not Talbot, but his solicitor, who remarked: 'What a very influential gentleman Mr Fox Talbot is, and how much he has done for photography! How much he is willing to do is known to very few, and I am one of the favoured ones, and he is just the man to be made the patron of photography.' Sims happily agreed, still thinking that he had been chosen for special favour. The solicitor continued that in view of Sims's recognition of Talbot's patronage he would induce Talbot to grant Sims a licence to work collodion photography. '"To what?" I said. "Are you not aware, young man," said the solicitor, "that Mr Talbot's patents embrace and include every branch of photography?"' Sims, so suddenly shocked and scarcely believing he had heard aright, composed himself to inquire the cost of a licence and was told that he would have to pay £350 a year in respect of his two studios, in Albany Street and Conduit Street, London. Sims was prepared to pay something reasonable to be left in peace–whether Talbot were right or wrong–but that sum, equal to his rents, would ruin him. 'If it comes to that', he replied to the solicitor, 'I may as well be ruined by *not* paying Mr Talbot, as be ruined by paying him.' Soon an injunction was issued and Sims was compelled to close both businesses.[31]

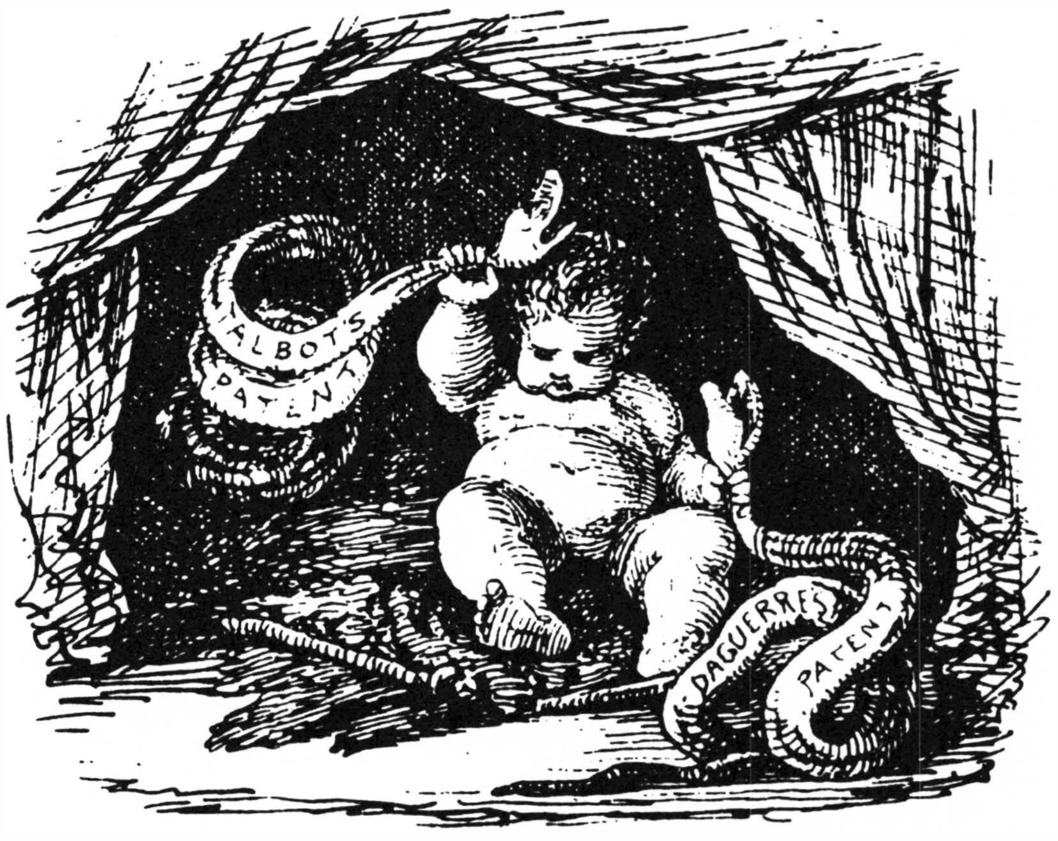
Talbot next threatened MISS WIGLEY, the only woman professional photographer, who had–like Sims–abandoned the daguerreotype in favour of collodion. But 'Miss Wigley, with all a woman's obstinacy, boldly stated her determination to brave alike Mr Talbot and the Vice-Chancellor. This maiden hero was too much for the hero of Lacock and the bachelor [*sic*] succumbed.'[32] A similar story was told by a Mr Cogan who opened a studio in Milsom Street, Bath, after the invention of the collodion process. He was asked by Talbot's solicitors to pay £300 in licence fees, but refused. He then made Ambrotypes which he transferred to plaster of Paris, with which he apparently evaded Talbot's prosecution threats.[33]

JAMES HENDERSON, who had two London studios, in Regent Street and the Strand, was another professional who refused to be intimidated, in spite of a warning issued by Talbot's solicitors in the leading newspapers.

> *Photographic Portraits. Collodion Process. Caution.* Talbot *v.* Henderson. His Honour Vice-Chancellor Wood has this day issued an injunction to restrain the defendant from making and selling photographic portraits by the above process without the licence of the patentee. Artists and others desiring to practice this branch of the photographic art are requested to apply to us. All infringers of the patent rights will be proceeded against.
> Price & Bolton, 1 Lincoln's Inn, New-square. May 26, 1854.[34]

Henderson contested the injunction. An appeal for a subscription to aid him was made in *Notes and Queries*, the editor of which, Dr Thoms, was a keen amateur photographer. Affidavits were sworn for Talbot by Sir John Herschel and Sir David

PHOTOGRAPHIC TABLEAUX.



THE INFANT PHOTOGRAPHY STRANGLING THE SERPENTS.

Fig 25 Caricature by 'Cuthbert Bede', 1855

Brewster, and for Henderson by Robert Hunt, Dr Charles Heisch, and others; but judgement was postponed, for Talbot's lawsuit against yet another photographer, Laroche, became a test-case which settled the matter once for all.

Talbot had issued an injunction against SILVESTER LAROCHE, a French Canadian with a studio in Oxford Street, in December 1853, but Laroche resisted, and in addition entered a *caveat* against Talbot's petition for an extension of his calotype patent term, soon to run out. In an appeal for assistance from his 'brother professionals' Laroche said: 'It is my intention to resist such application to the utmost of my power, and in so doing I trust that I may meet with the well wishes and support of all who are interested in the art of photography.'[35] Laroche's aim was twofold: (1) To prove that the collodion process was different from the calotype and therefore did not come under Talbot's patent. (2) To prevent Talbot from renewing that patent, in case judgement under (1) went against him.

This was the spark in the powder-barrel. The harshness of Talbot's proceedings, after the collodion process had been in general use for two years, roused public opinion, which was already much opposed to his absurd and unjust attempts to monopolize photography. An Extraordinary Meeting of the Photographic Society was called on 6 July, for in defending this action Laroche was not merely defending his own interests but those of every practising photographer in England: it was the general opinion that Talbot's claim to the monopoly of the collodion process could not be sustained.

The trial, which lasted for three days, was attended by the leading scientists and professional photographers of Britain, both as witnesses and as spectators. The prosecution tried to prove that photography with collodion was essentially the same as with the calotype. The defence set out to show (*a*) that Talbot's patent was bad because he was not the true inventor of the calotype, having been anticipated in the use of gallic acid by the Rev. J. B. Reade; (*b*) that the collodion process was different from the calotype and did not come under the patent.

In summing up, Lord Chief Justice Jervis pointed out that there were two aspects of the case, the academic and the financial.

> There is no doubt that to gentlemen in the position of Mr Talbot and Mr Reade . . . it is of importance that it should be ascertained who was the inventor. . . . In

> addition, it is of importance to Mr Talbot in a pecuniary point of view: for no doubt, either by reason of the improvements in the art, or otherwise, the practice of taking portraits by this system [collodion] has become so extensive, that if he were entitled by your verdict to say that the collodion process is an infringement of his process, and cannot be practised without his licence, no doubt it becomes a very valuable, a most valuable, patent in his hands.[36]

After an hour's deliberation, the special jury found that Talbot was 'the first and true inventor within the meaning of the patent laws', i.e. *the first to publish*; but that Laroche was not guilty of infringing the calotype patent by taking collodion portraits.

Although Talbot had the moral satisfaction of being proclaimed the inventor of the calotype, the verdict did not at all please him. 'The jury', he wrote to his wife, 'understood little of the subject, but trusted to the judge, and the judge fell into awful mistakes, not being able to comprehend the process which he had never tried. It is impossible we can rest content with the summing up of the judge.' But he abandoned his project of appealing, and thus on 20 December 1854 the collodion process was thrown open to the world 'amidst loud and continued cheering', and through the courageous defence of Silvester Laroche the infant art of photography had at last freed itself from the shackles of the patents. Though he won the case, Laroche had incurred heavy costs, said to have been between £400 and £500,[37] and in the hope that photographers would show their gratitude by reimbursing him the expenses he had incurred as much for their benefit as for his own, a fund was opened, but proved insufficient to meet the costs. Fig 25

Laroche had achieved his second object as well, for Fox Talbot dropped his application for renewal of the calotype patent, knowing that it would not bring him any financial advantage now that collodion had been judged free.

The daguerreotype patent had run its term in 1853, and so all the photographic processes were now open to anyone, amateur or professional, and in 1855 photography in England was at last on an equal footing with the rest of the world.

On 2 May 1857 Scott Archer died at the age of forty-four, worn out with the struggle for his bare existence, and having spent all his money and energy on various improvements to photography. The collodion process had provided thousands of photographers with a fascinating hobby or a remunerative profession, yet among the many photographic societies that owed their existence to the popularization of photography by Archer's invention, only the Manchester Photographic Society acknowledged their indebtedness during his lifetime. The London Photographic Society, urged on two occasions by the portrait photographer J. E. Mayall to show their gratitude to the inventor by a testimonial, formed a committee, but nothing more was done, and Archer never received what Mayall called 'that reward which I am quite certain he deserved at the hands of every photographer, not only in England but in Europe, not only in Europe, but in every portion of the civilized world'.

Though it was too late to repair the injustice which had saddened and perhaps hastened Archer's end, on the day of his funeral the Photographic Society decided that there was still time to offer some tribute to his memory, and in an endeavour to make some amends to his widow and three children, left totally unprovided for, a fund was opened, which even moved *Punch* to wholehearted support.

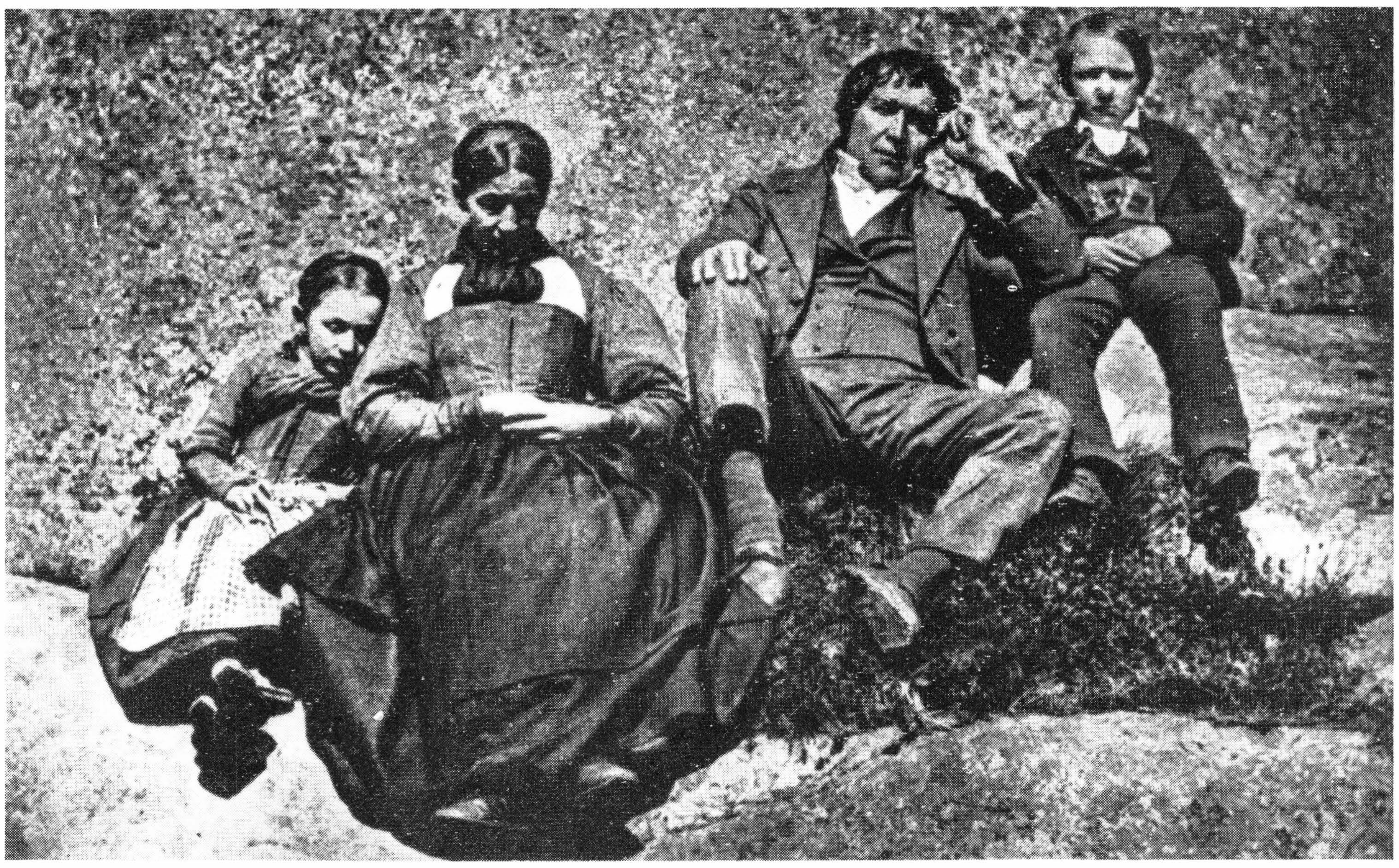
> To the Sons of the Sun.
>
> The inventor of Collodion has died, leaving his invention, unpatented, to enrich thousands, and his family unportioned, to the battle of life. Now, one expects a

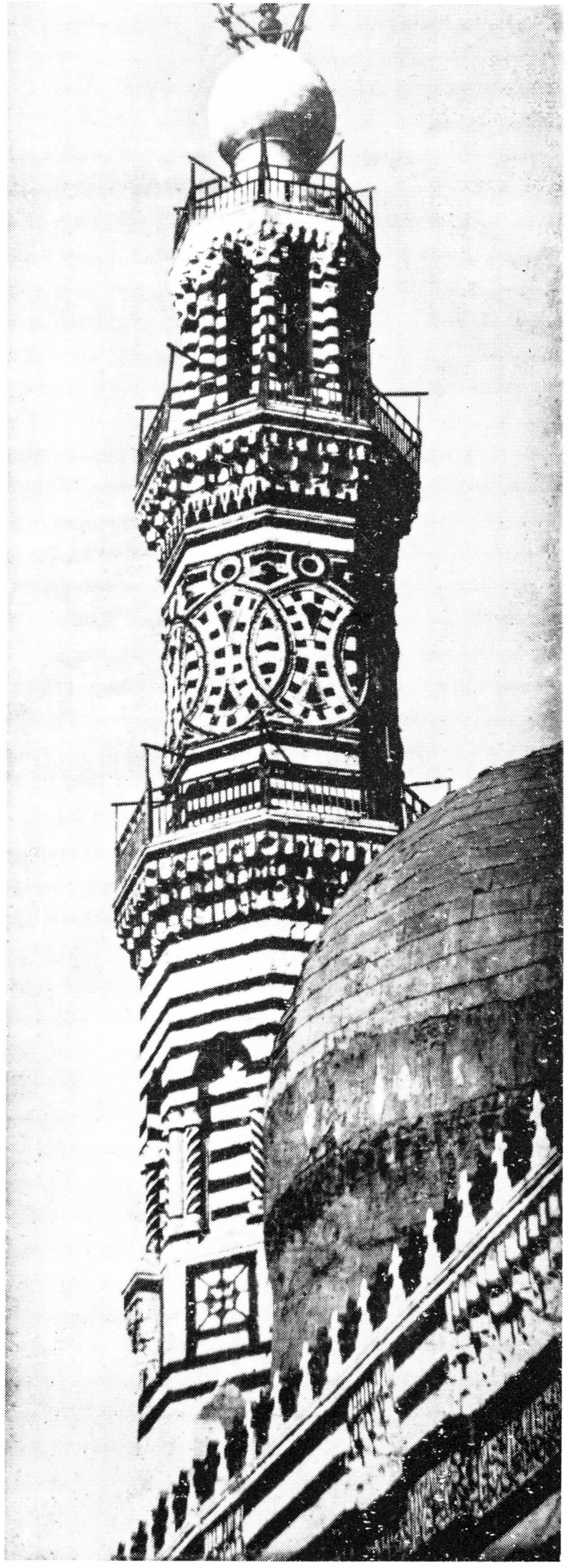
> photographer to be almost as sensitive as the Collodion to which Mr Scott Archer helped him. A deposit of silver is wanted (gold will do) and certain faces, now in the dark chamber, will light up wonderfully, with an effect never before equalled by photography. A respectable ancient writes, that the statue of Fortitude was the only one admitted to the Temple of the Sun. Instead whereof, do you, photographers, set up Gratitude in your little glass temples of the sun, and sacrifice, according to your means, in memory of the benefactor who gave you the deity for a household god. Now, answers must not be Negatives.[38]

The Prime Minister, Lord Palmerston, was approached in an effort to obtain a pension for the family, but although Sir William Newton stressed that Archer's discovery saved the Government £30,000 a year in the production of Ordnance Survey maps, only an annuity of £50 was granted from the Civil List, a sum which appears the more niggardly when compared with the liberal pensions bestowed by the French Government upon Daguerre and Niépce. Less than a year after her husband Mrs Archer died, having received only £98 from the photographer's fund which was being slowly collected. When the Photographic Society closed the subscription list in August 1859 the total sum available for the orphans was only £767. The smallness of the amount and the long time it had taken to collect it will for ever remain a reproach to photographers.

No obituary of Archer appeared in any of the photographic journals, and considering that D. O. Hill and many another leading photographer fared no better, we are not surprised at the indifference shown by the *Dictionary of National Biography* towards those who made British photography famous in the nineteenth century.

Plates 43–96

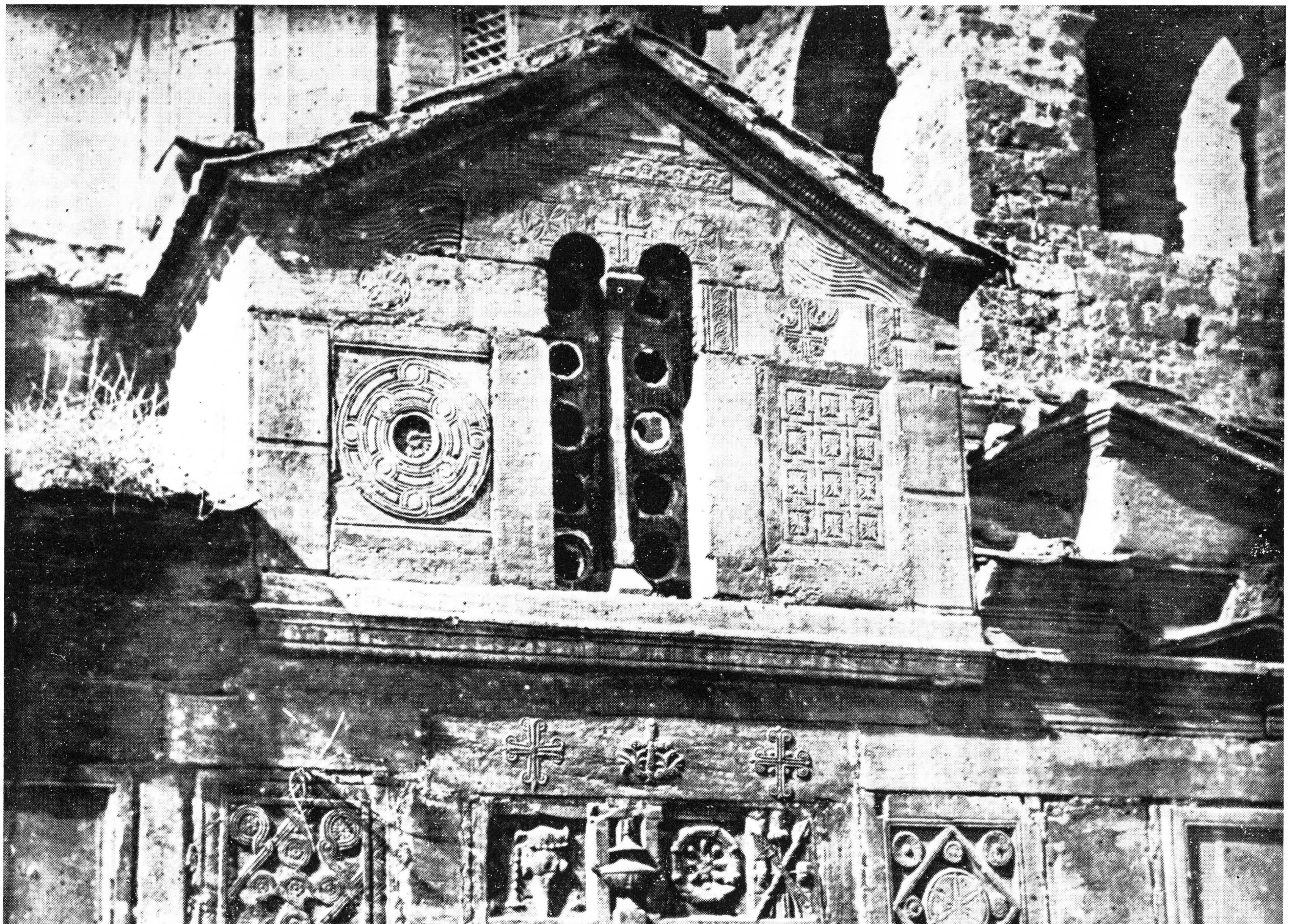


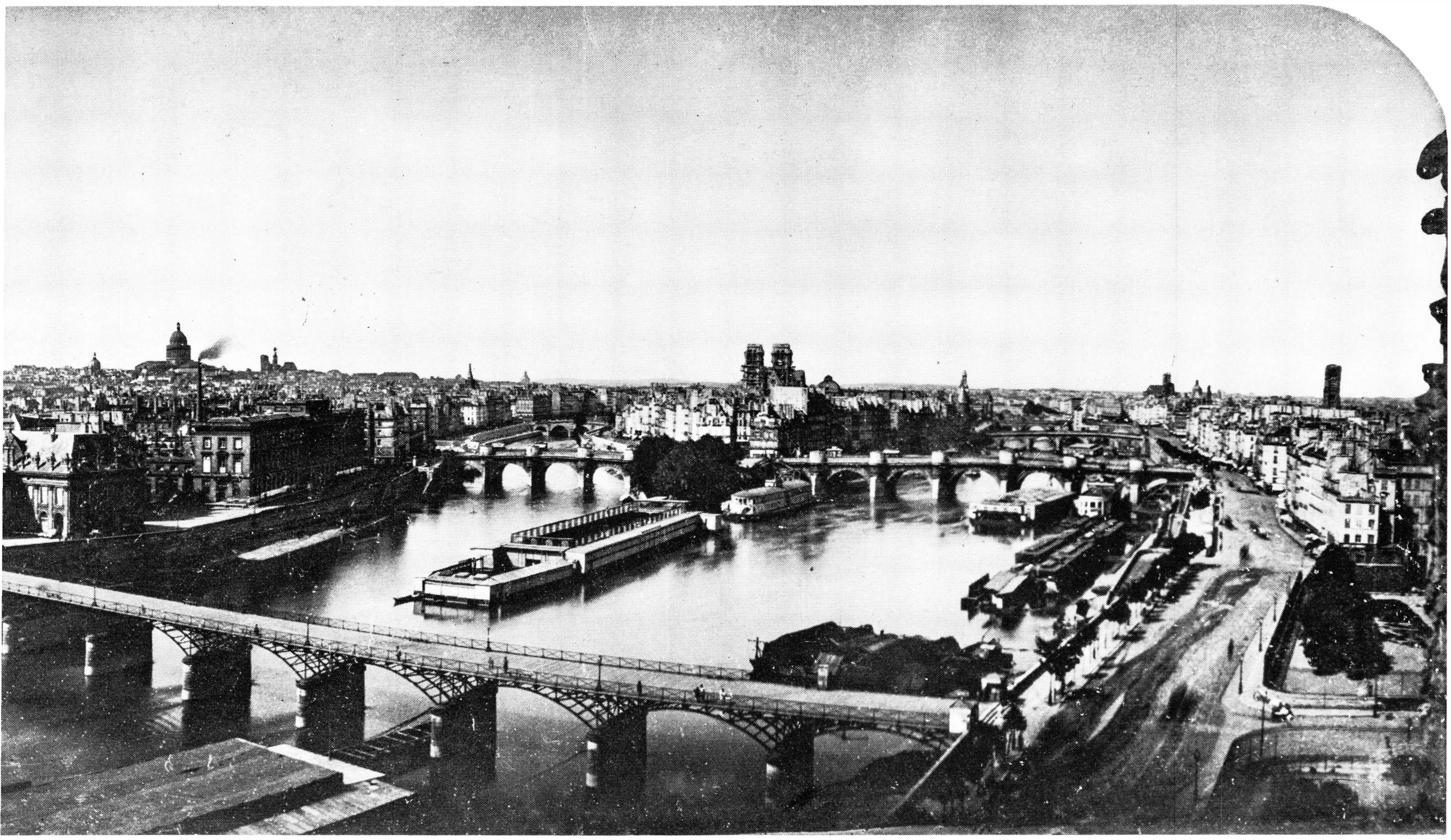


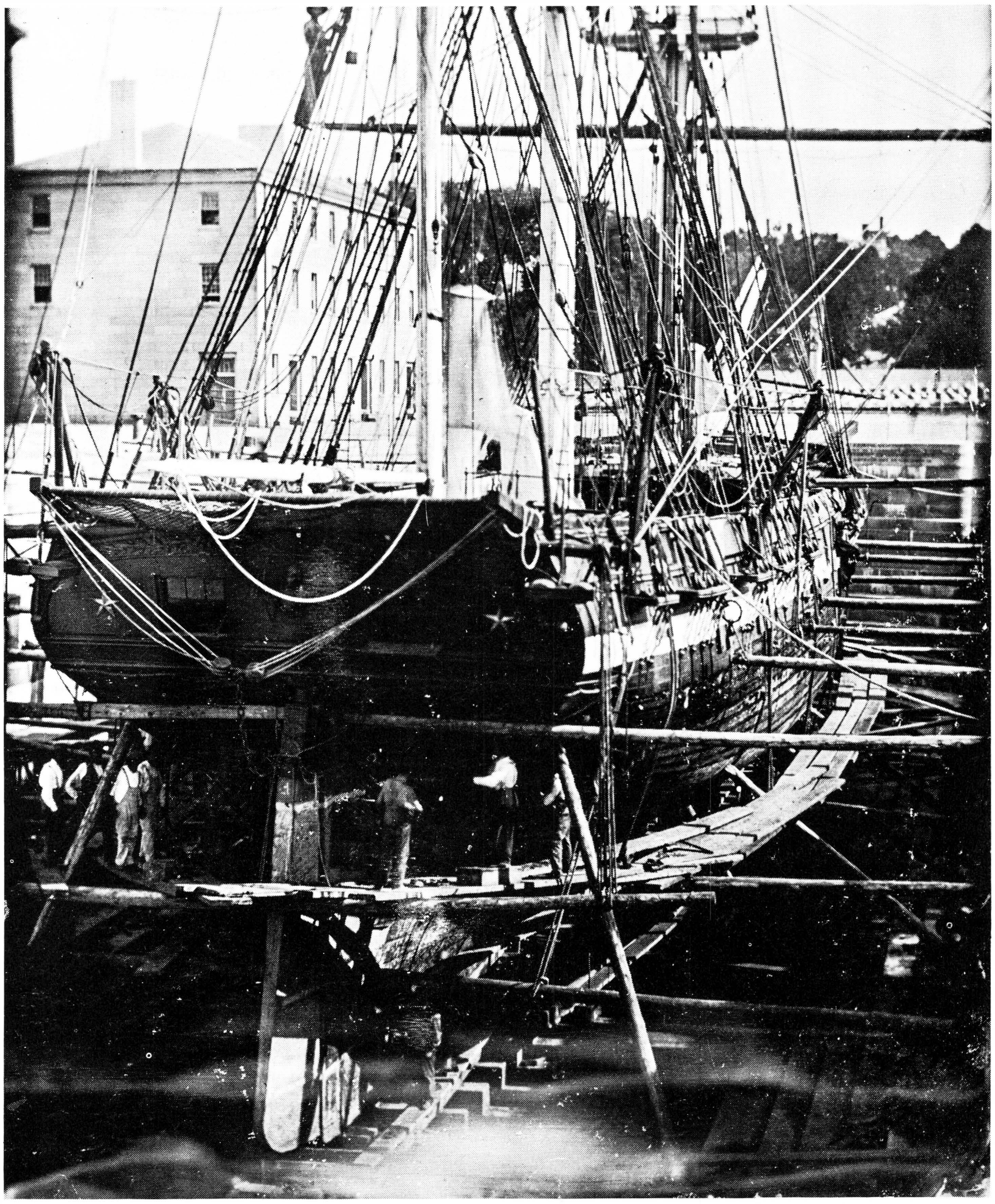
43 ADOLPHE BRAUN. Open-air group, daguerreotype, *c.* 1843. Reproduction.

44 J. P. GIRAULT DE PRANGEY. Mosque of Kalaun, Cairo (detail), daguerreotype 3¾ in. × 9½ in., dated 1842

45 J. P. GIRAULT DE PRANGEY. The Cathedral, Athens (detail), daguerreotype 7½ in. × 9½ in., 1842



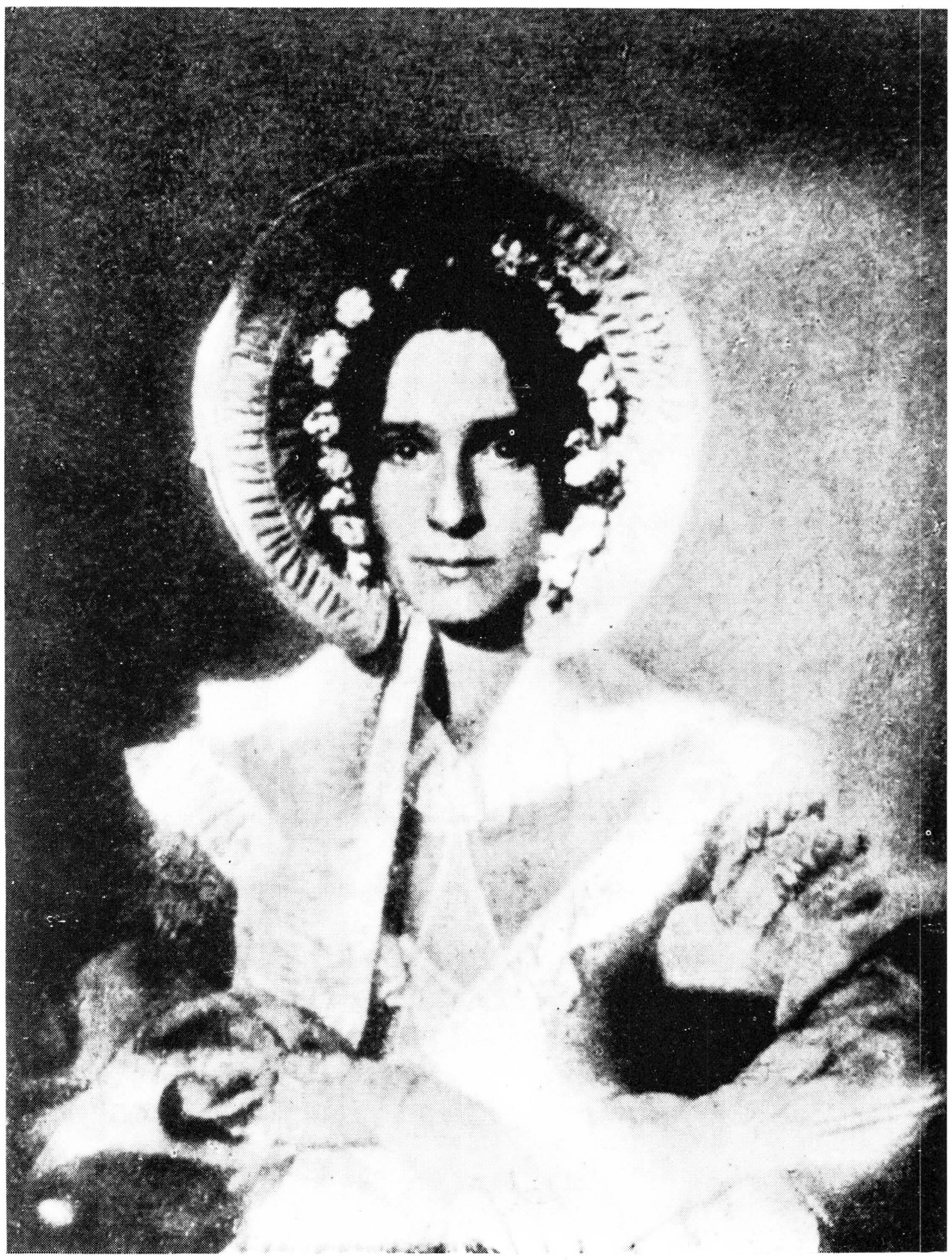




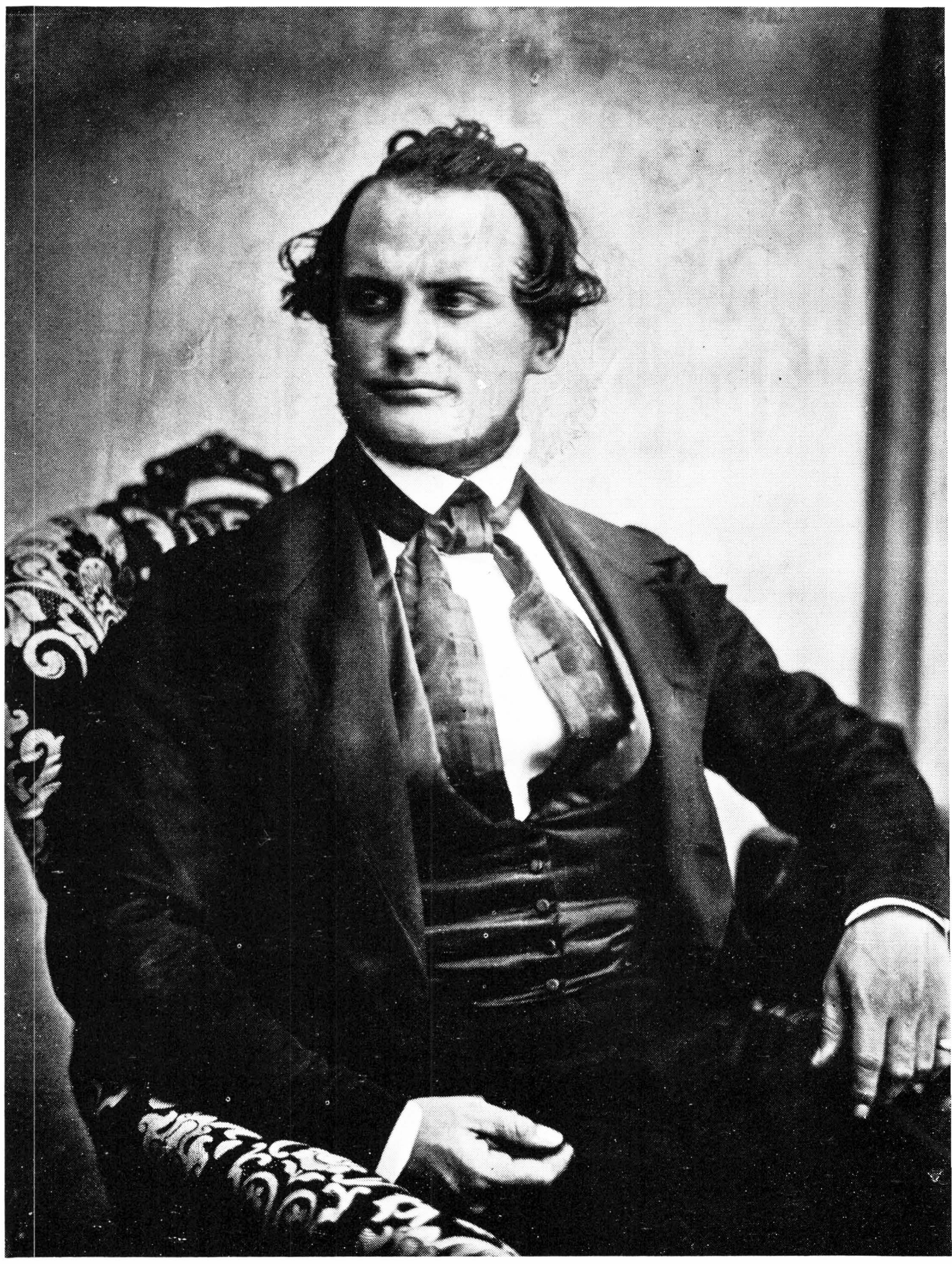
46 FRIEDRICH VON MARTENS. Panoramic view of Paris from the Louvre, daguerreotype $3\frac{3}{4}$ in. × $12\frac{1}{2}$ in., 1846

47 L. J. M. DAGUERRE. Daguerreotype of an artist, possibly his brother-in-law, Charles Arrowsmith, $4\frac{1}{8}$ in. × $3\frac{1}{4}$ in., 1842–3. (This is the only daguerreotype known to have been signed by the inventor.)

48 SOUTHWORTH & HAWES. A vessel in Boston dry dock, daguerreotype, *c.* 1850

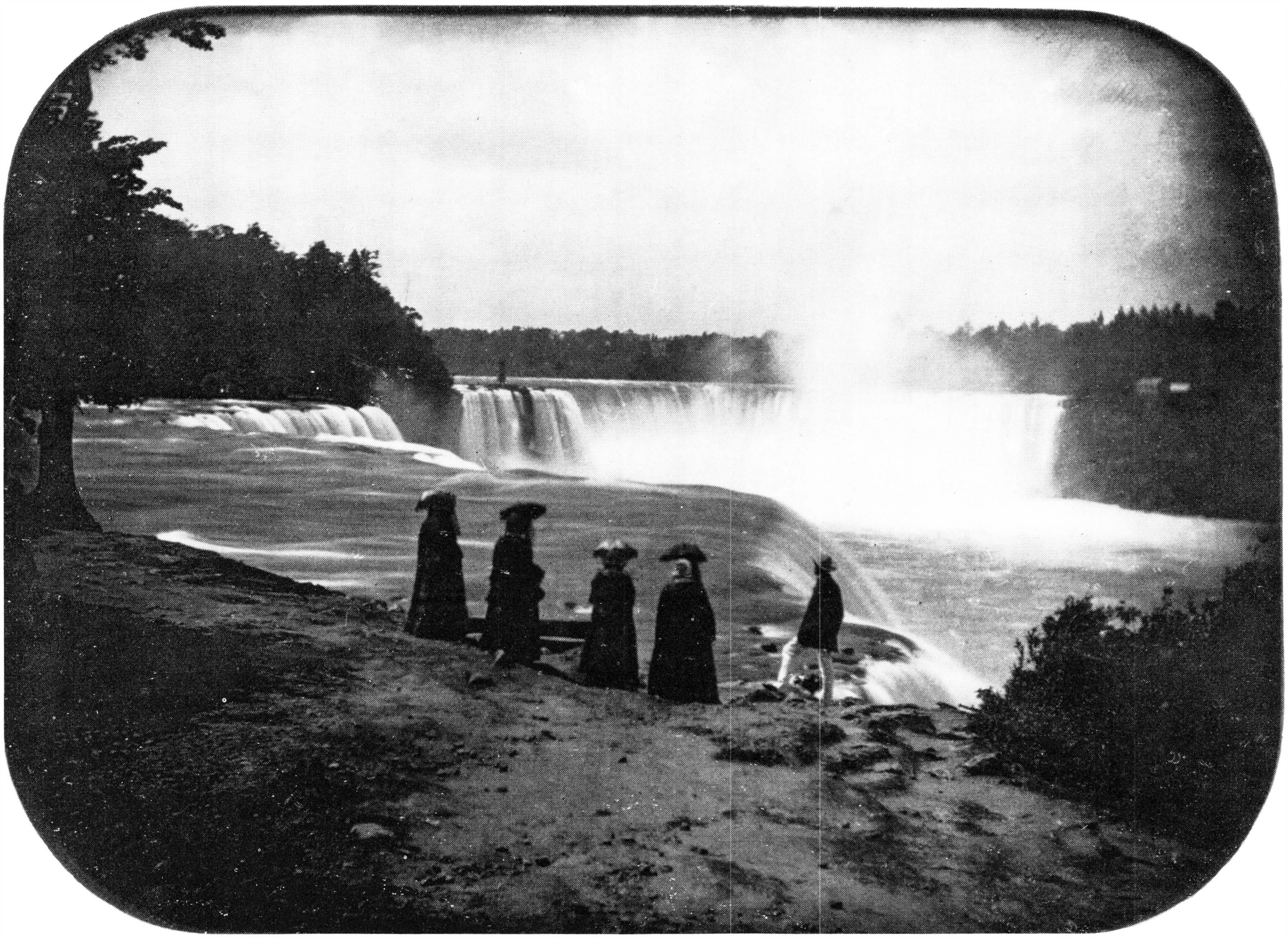


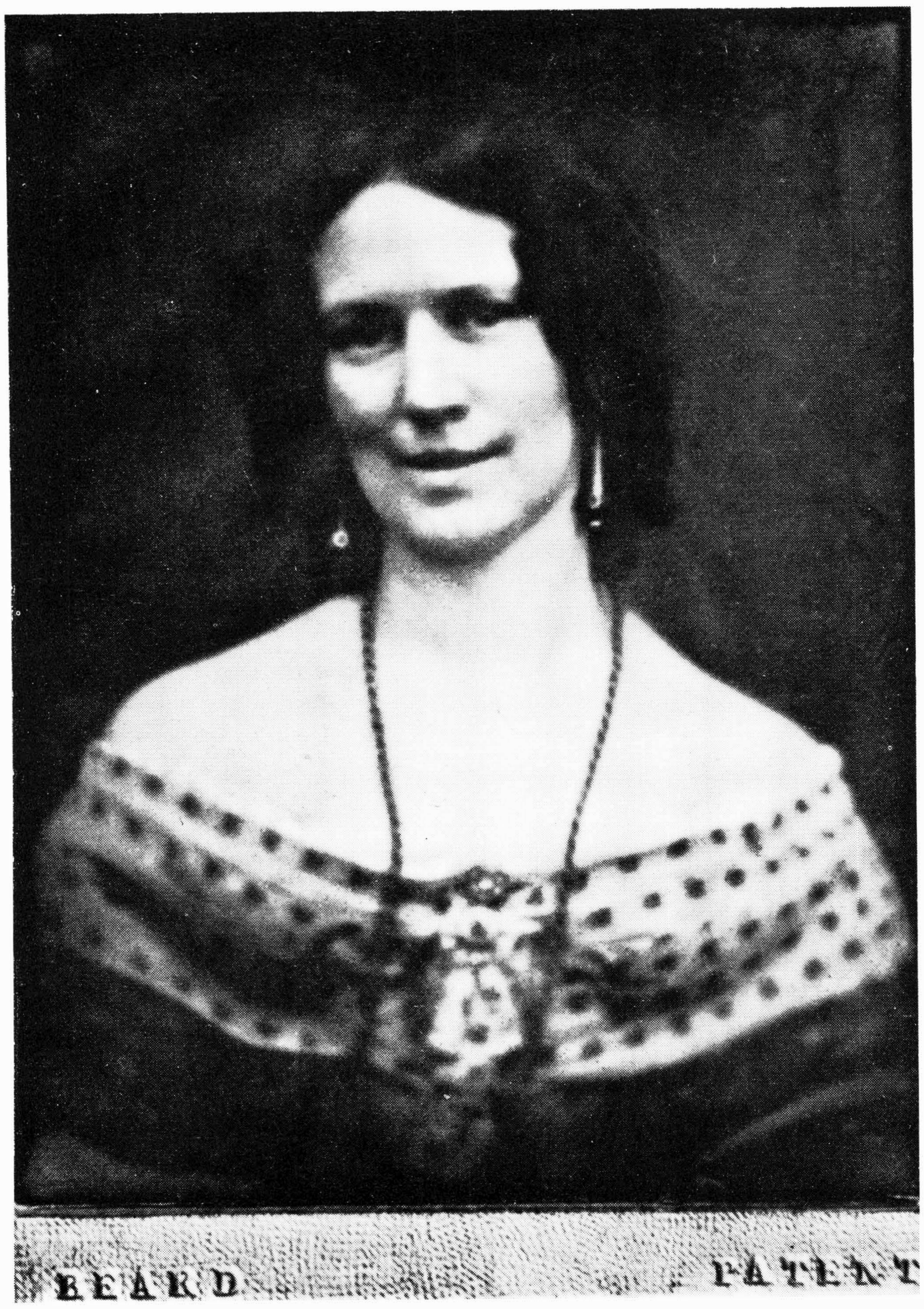
49 JOHN W. DRAPER. Daguerreotype of his sister, Dorothy Catherine Draper, $3\frac{1}{2}$ in. × $2\frac{3}{4}$ in., June 1840. Original destroyed

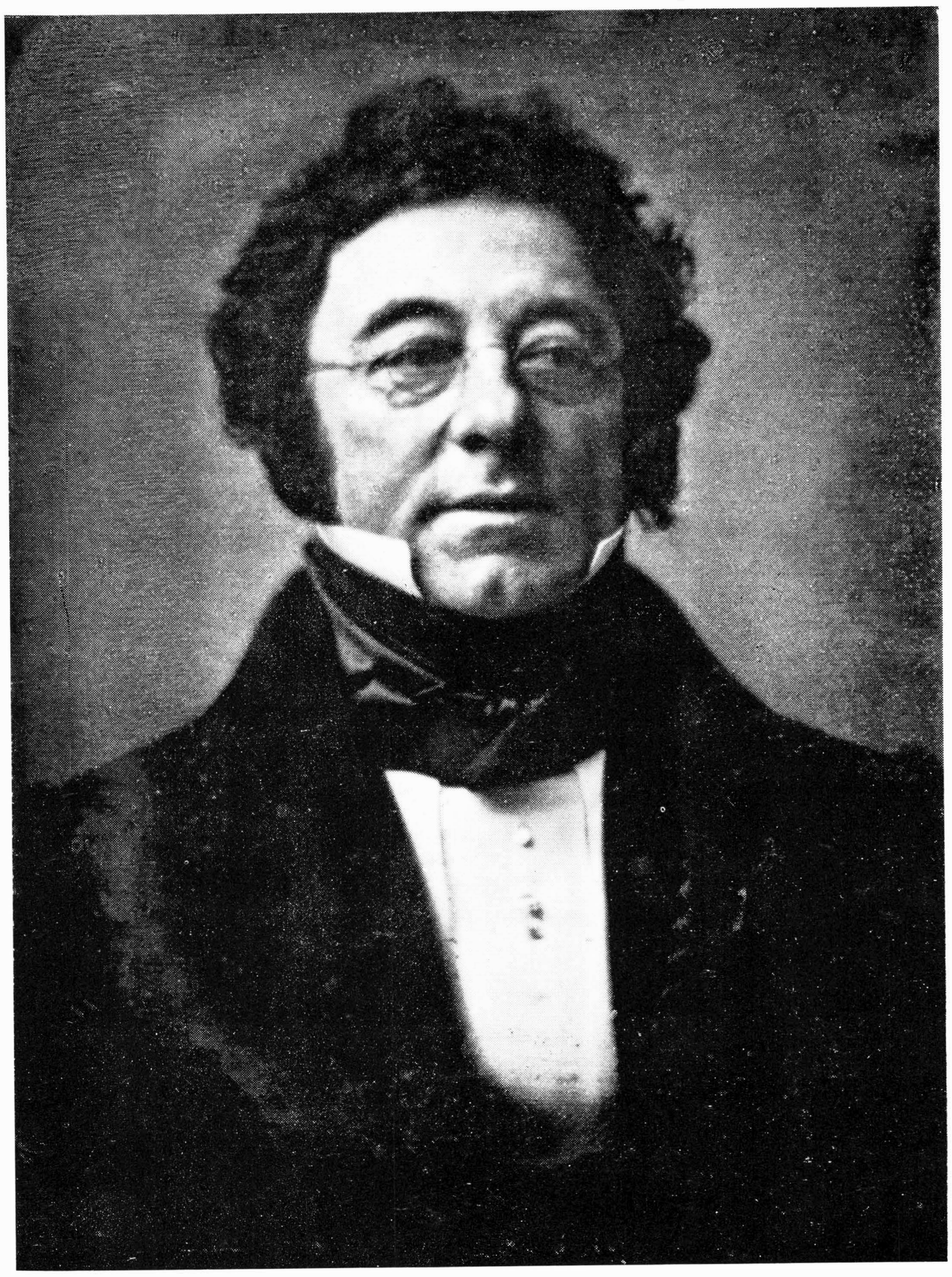


50 J. J. HAWES. Daguerreotype of DONALD MCKAY, $16\frac{5}{8}$ in. × $12\frac{7}{8}$ in.

51 PLATT D. BABBITT. The Niagara Falls. Daguerreotype $5\frac{1}{4}$ in. × $7\frac{1}{4}$ in., 1853





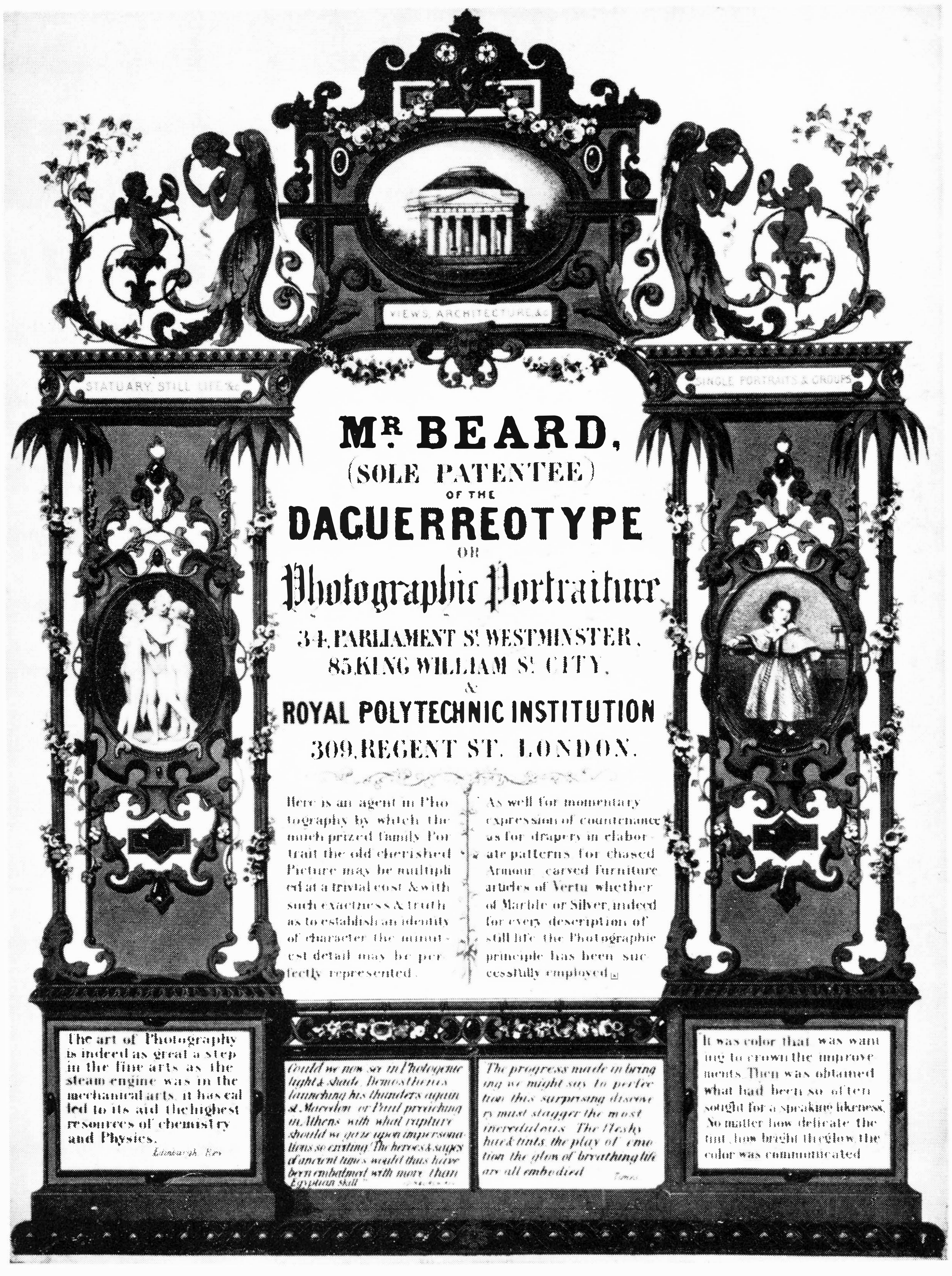


52 RICHARD BEARD. Portrait of a lady, 1½ in. × 2 in., dated 1842. One of the earliest British daguerreotype portraits.

53 RICHARD BEARD. Daguerreotype portrait of a gentleman, 1½ in. × 2 in., *c.* 1842

54 Back of BEARD daguerreotype case, 1½ in. × 2 in., 1842

55 RICHARD BEARD's trade card, *c.* 1843. Science Museum, London.


VIEWS, ARCHITECTURE &c
STATUARY, STILL LIFE &c
SINGLE PORTRAITS & GROUPS

MR. BEARD,
(SOLE PATENTEE)
OF THE
DAGUERREOTYPE
OR
Photographic Portraiture
34, PARLIAMENT ST. WESTMINSTER,
85, KING WILLIAM ST. CITY,
&
ROYAL POLYTECHNIC INSTITUTION
309, REGENT ST. LONDON.

Here is an agent in Photography by which the much prized family Portrait the old cherished Picture may be multiplied at a trivial cost & with such exactness & truth as to establish an identity of character the minutest detail may be perfectly represented.

As well for momentary expression of countenance as for drapery in elaborate patterns for chased Armour carved Furniture articles of Vertu whether of Marble or Silver, indeed for every description of still life the Photographic principle has been successfully employed.

The art of Photography is indeed as great a step in the fine arts as the steam engine was in the mechanical arts, it has called to its aid the highest resources of chemistry and Physics.

Edinburgh Rev

"Could we now see in Photogenic light & shade Demosthenes launching his thunders against Macedon or Paul preaching in Athens with what rapture should we gaze upon impersonations so exciting! The heroes & sages of ancient times would thus have been embalmed with more than Egyptian skill"

The progress made in bringing we might say to perfection this surprising discovery must stagger the most incredulous. The Fleshy hue & tints the play of emotion the glow of breathing life are all embodied

Times

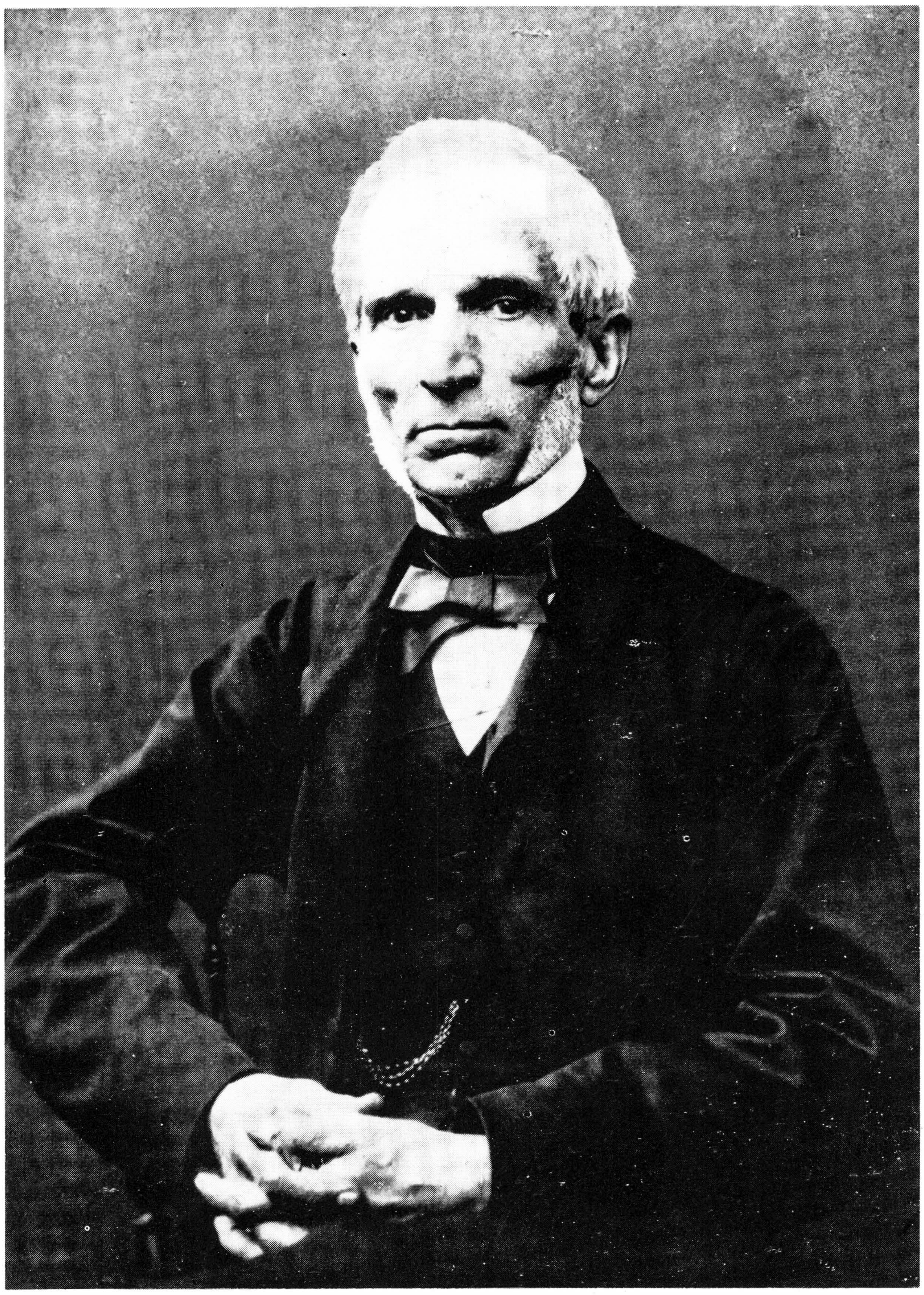
It was color that was wanting to crown the improvements. Then was obtained what had been so often sought for a speaking likeness. No matter how delicate the tint, how bright the glow the color was communicated

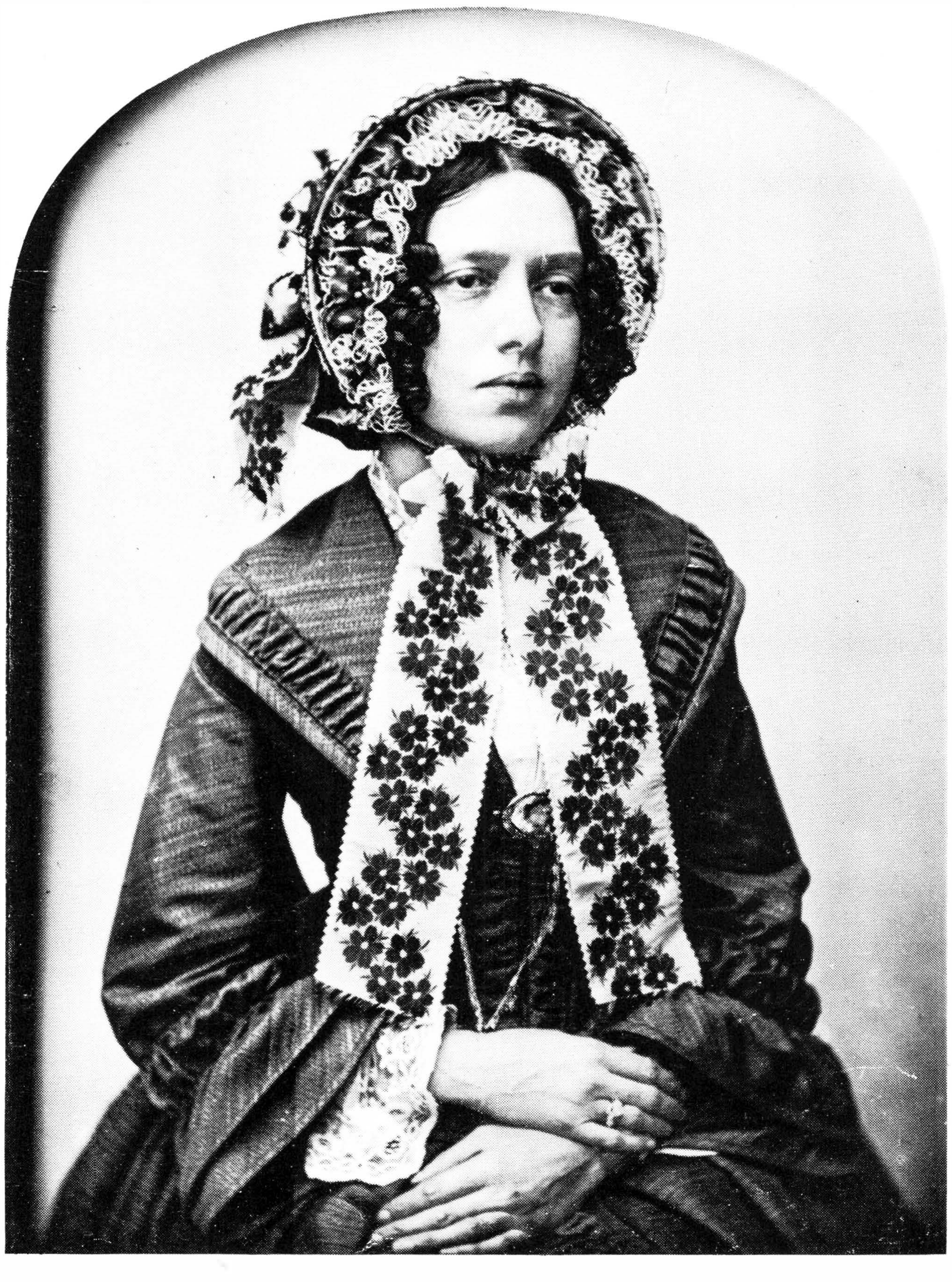
56 ANTOINE CLAUDET. Daguerreotype of a lady, 2 in. × $2\frac{1}{2}$ in., *c.* 1845

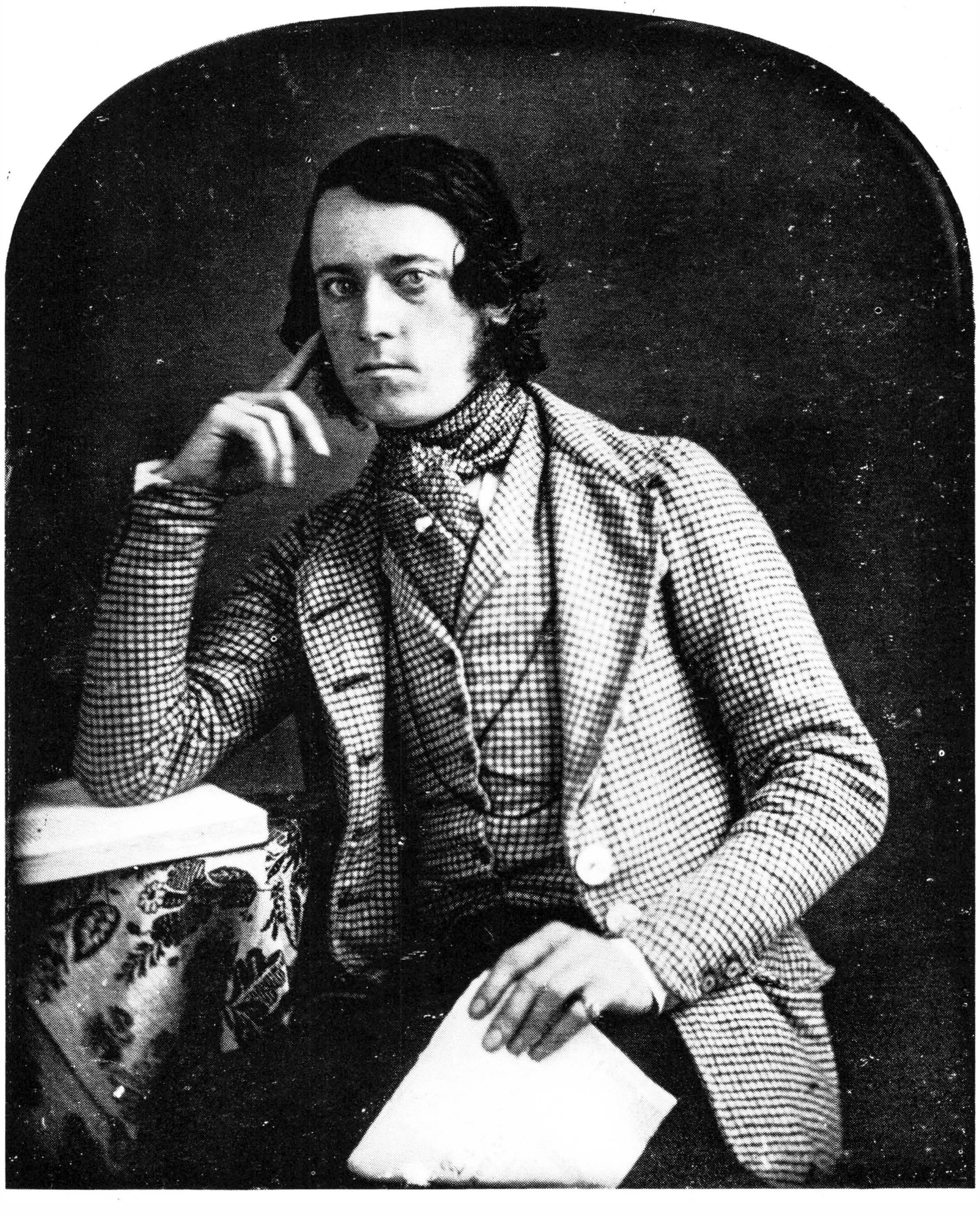
57 ANTOINE CLAUDET. Portrait by his son Henri, *c.* 1865

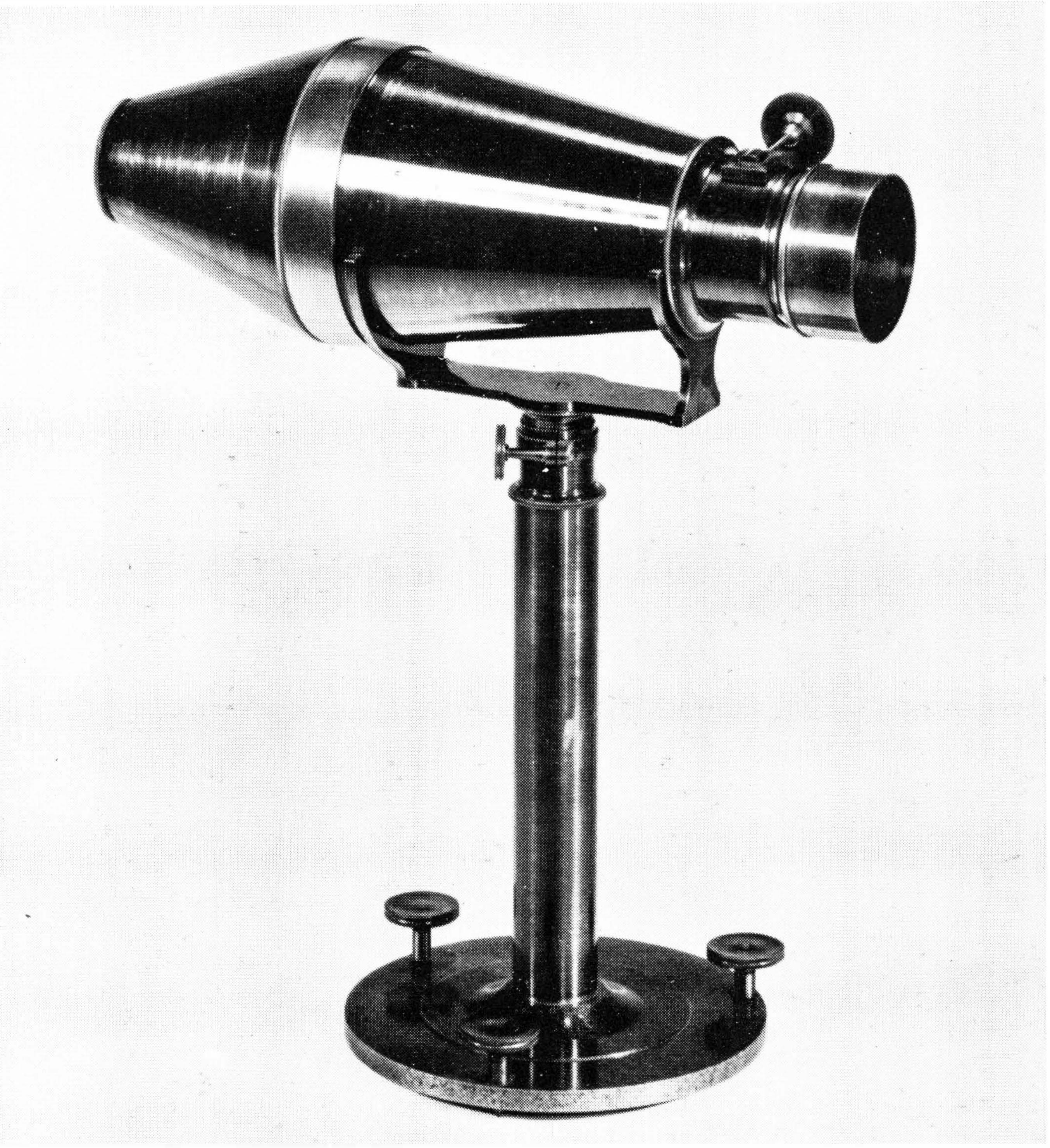
58 WILLIAM TELFER. Coloured daguerreotype of a lady, $1\frac{5}{8}$ in. × $2\frac{1}{8}$ in., *c.* 1848

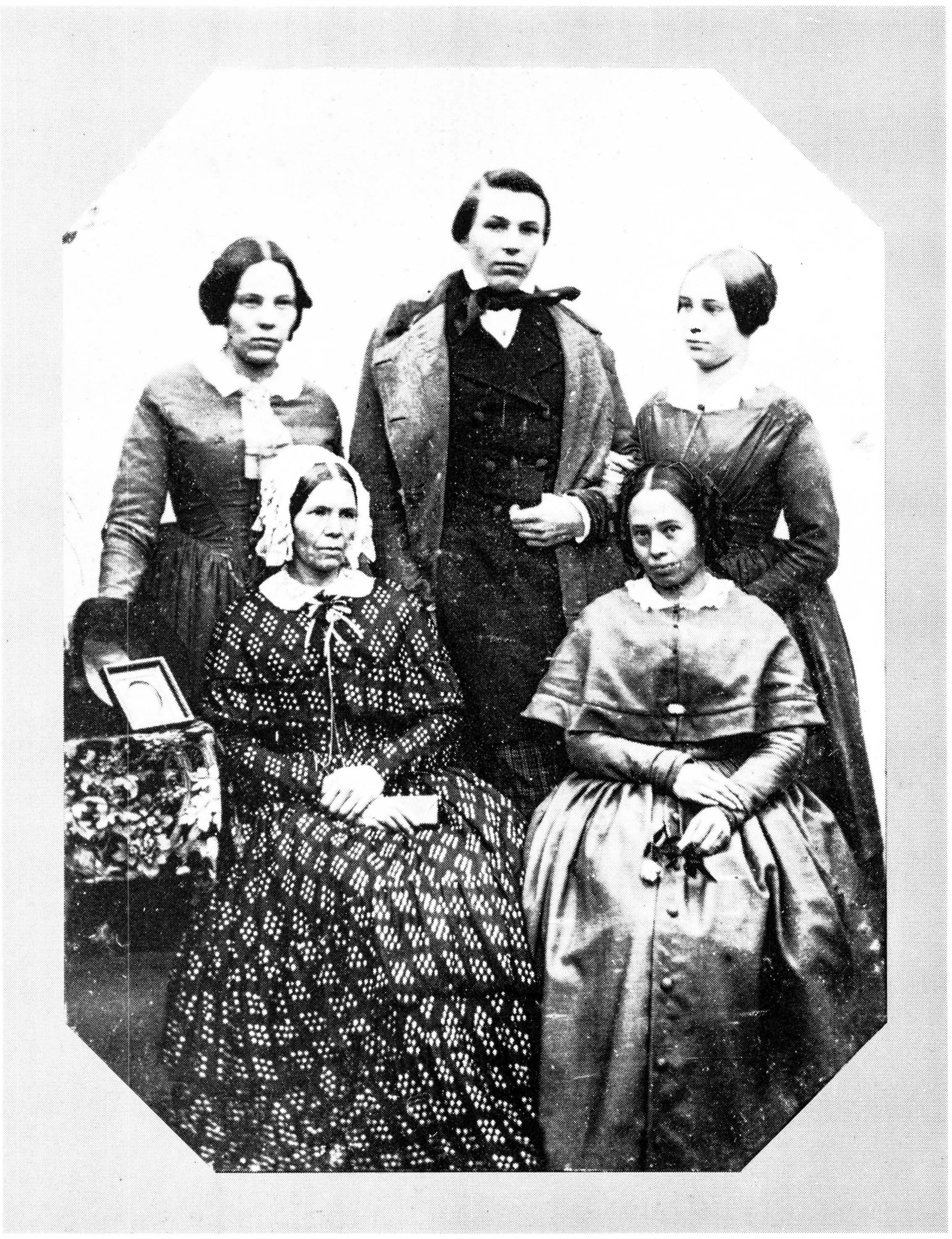
59 Unknown daguerreotypist. Portrait of a gentleman, $2\frac{1}{4}$ in. × $2\frac{3}{4}$ in., *c.* 1845

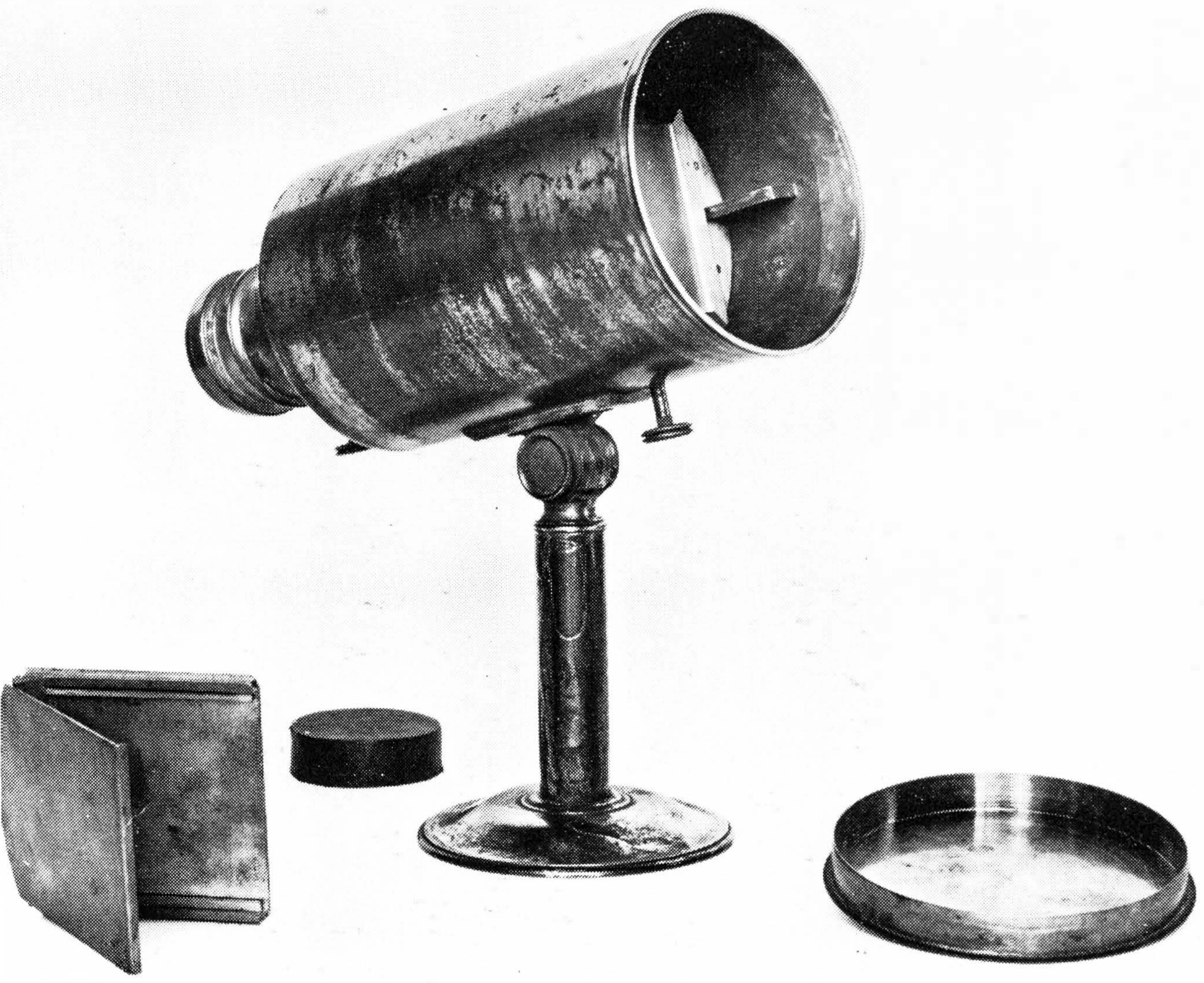










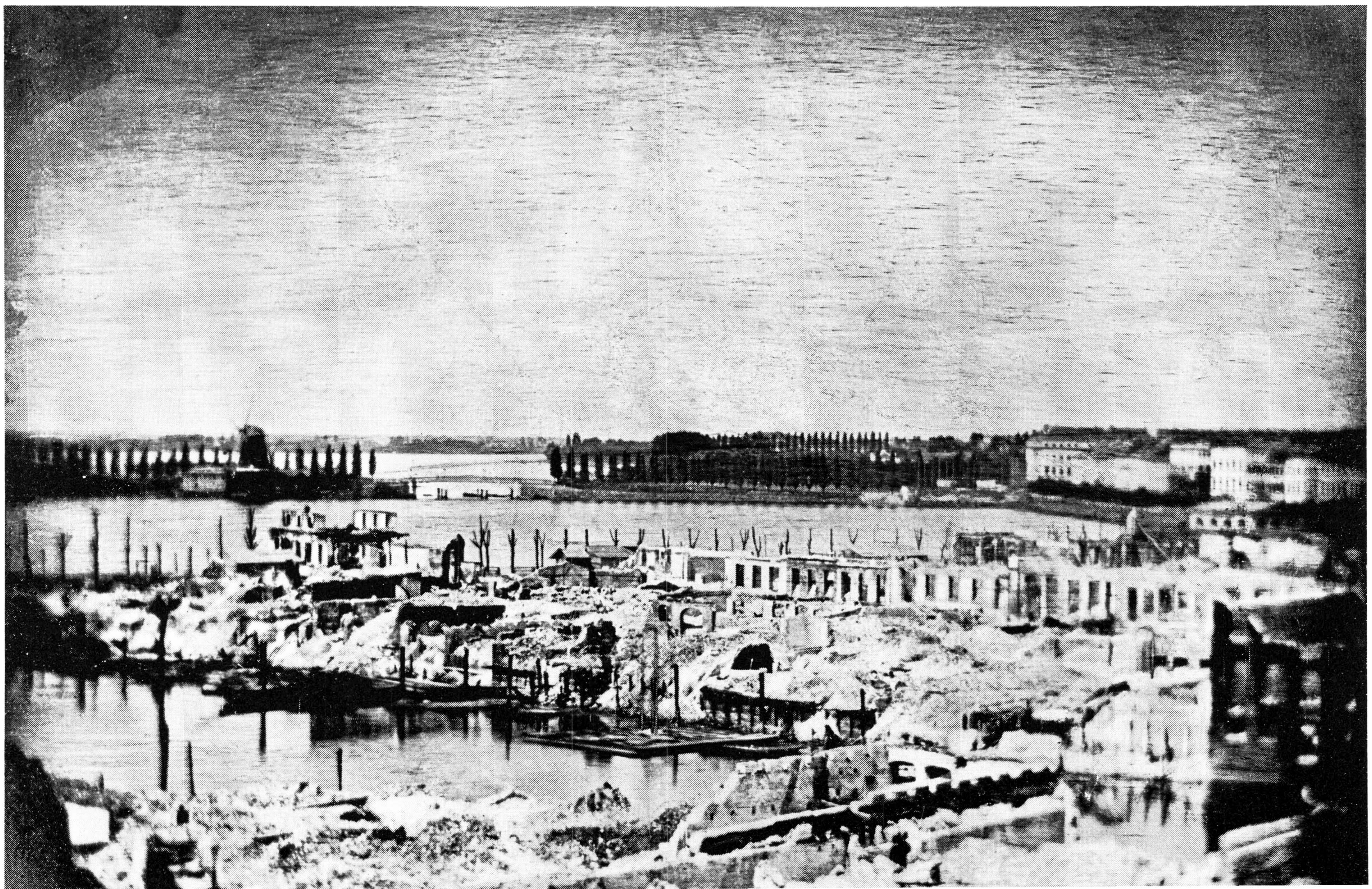


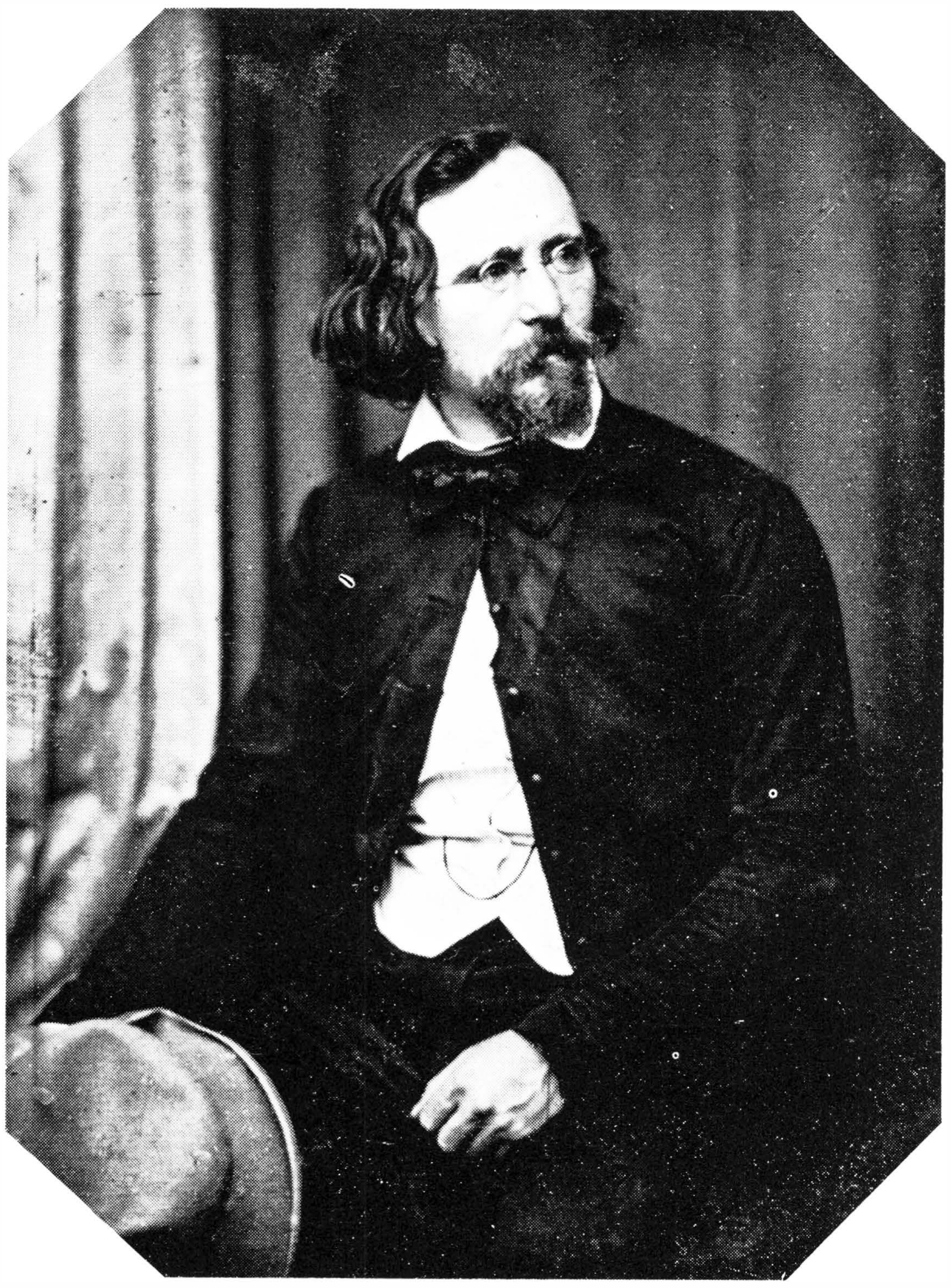
60 Voigtländer metal daguerreotype camera, 1841. Replica presented to the Gernsheim Collection by Voigtländer A.G.

61 THOMAS DAVIDSON's metal daguerreotype camera, *c.* 1842. Royal Scottish Museum, Edinburgh

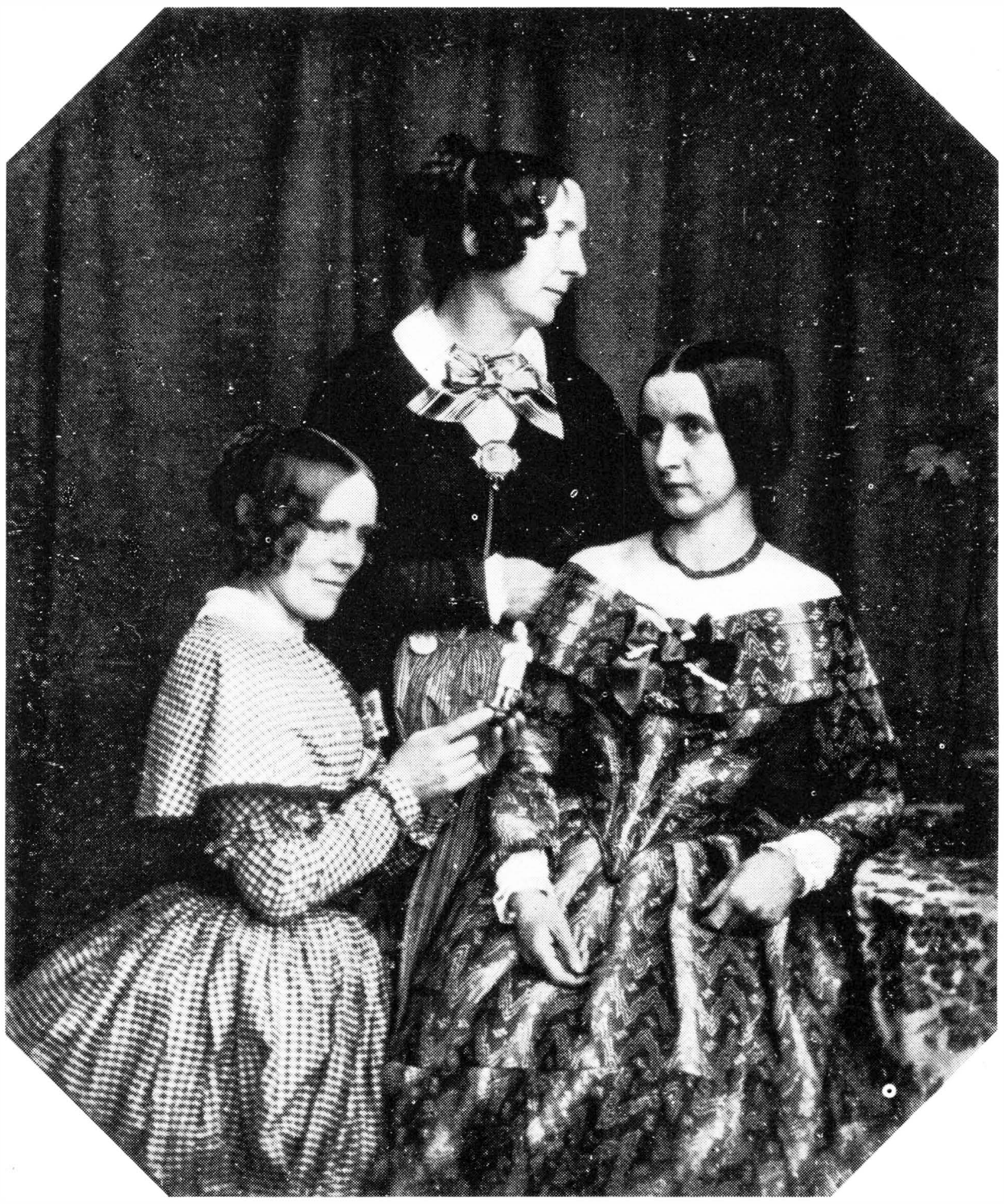
62 Unknown Austrian photographer. Daguerreotype group, 3¾ in. × 2¾ in., *c.* 1843

63 C. F. STELZNER. Ruins of Hamburg after the great fire. Daguerreotype, May 1842



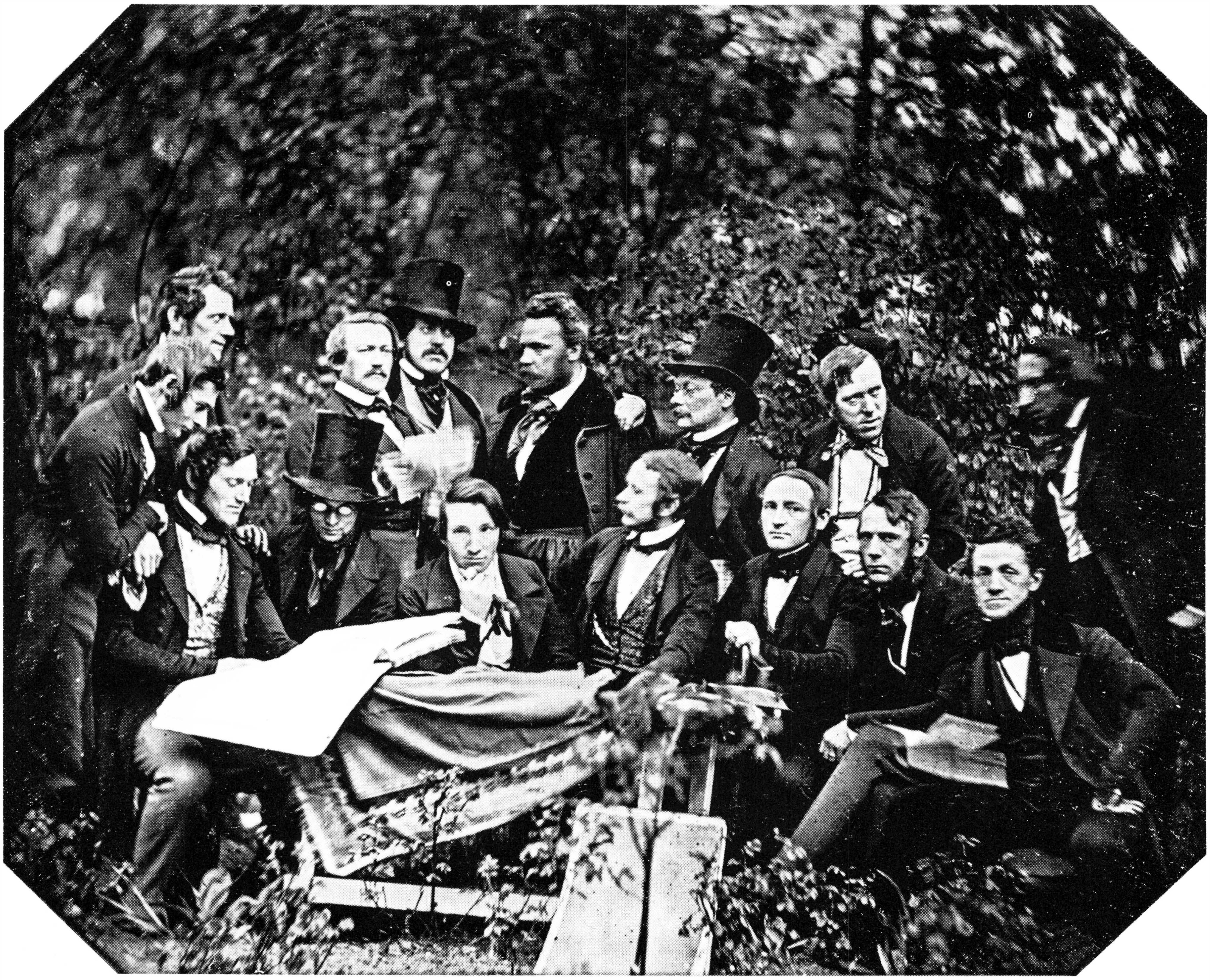


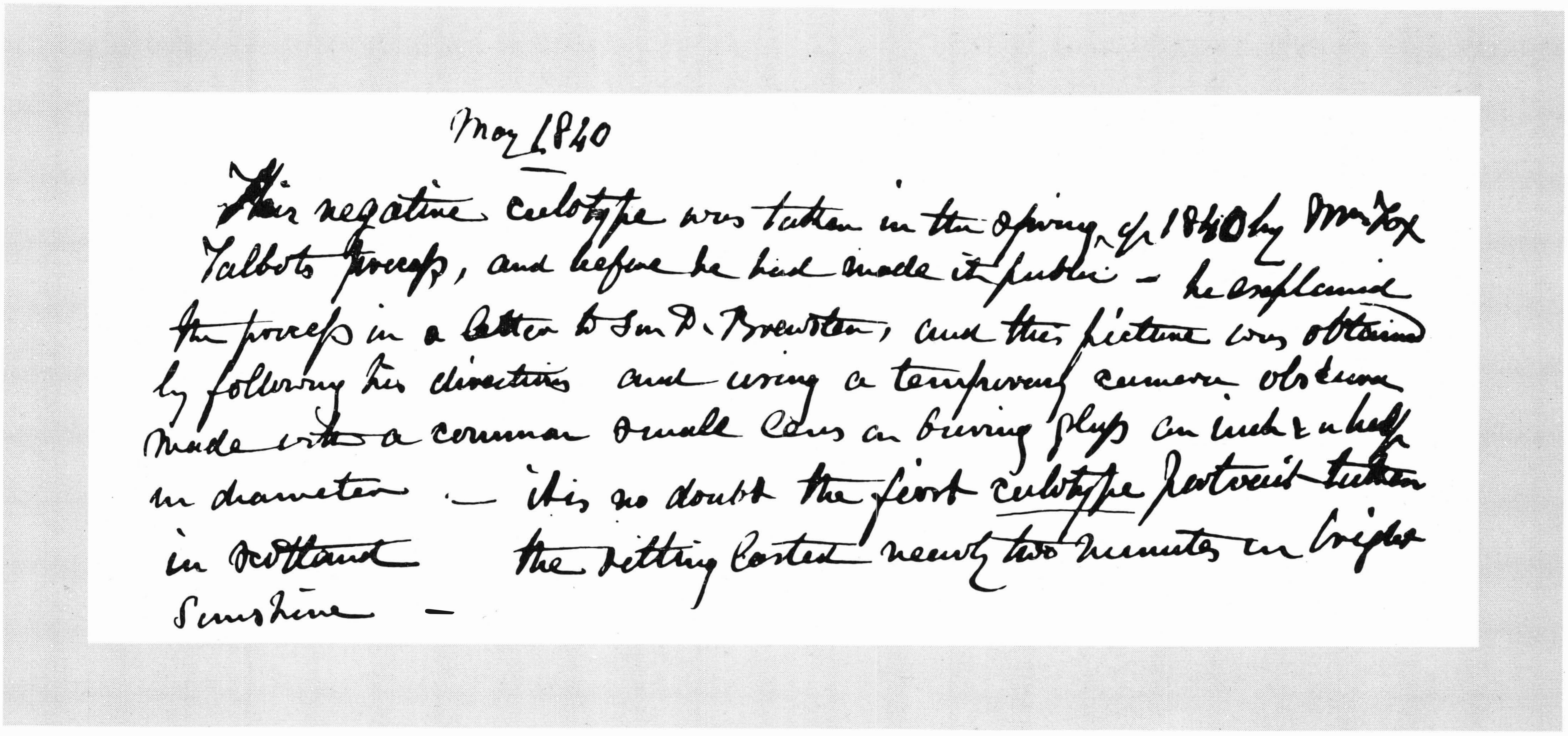
64 HERMANN BIOW. Jakob Venedey, Member of Parliament for Homburg. Daguerreotype, 1848



65 C. F. STELZNER. Daguerreotype group, $2\frac{3}{4}$ in. × $2\frac{1}{2}$ in., *c.* 1842

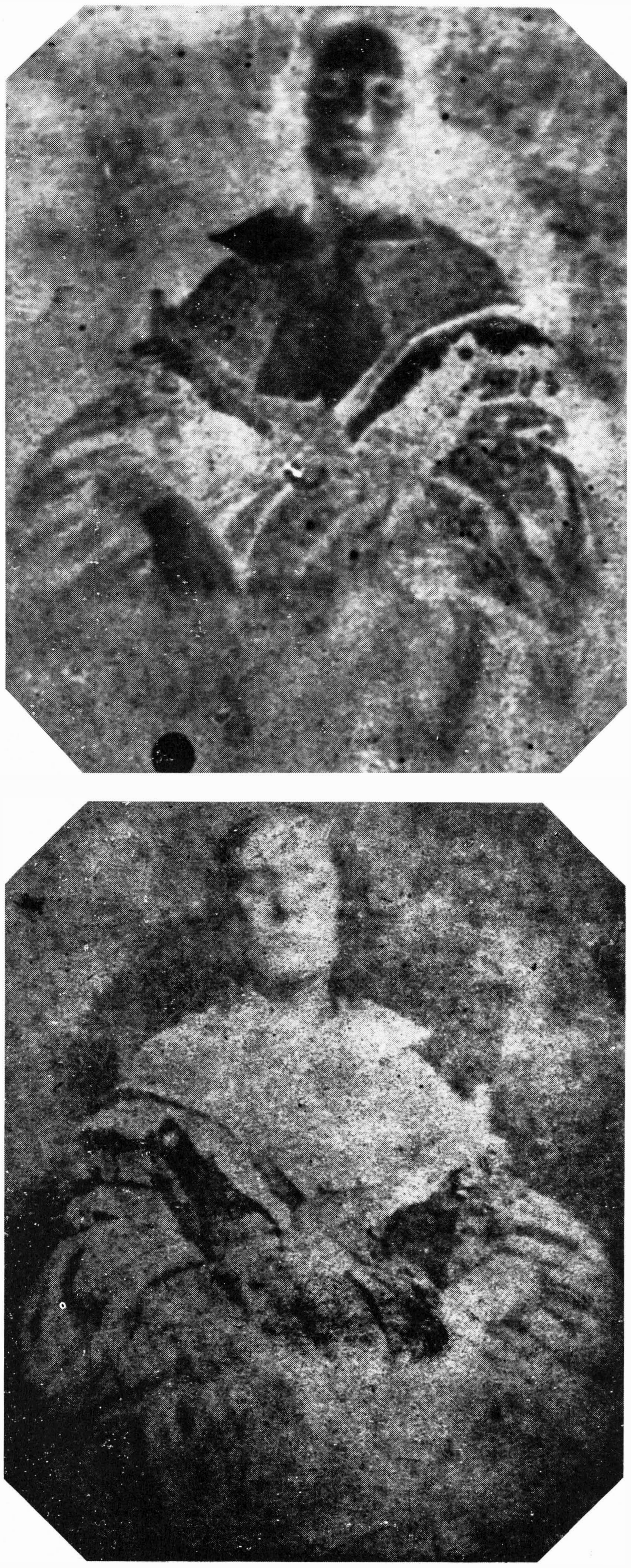
66 C. F. STELZNER. Outing of Hamburg art club. Daguerreotype, May 1843





May 1840

This negative calotype was taken in the spring of 1840 by Mr Fox Talbots process, and before he had made it public – he explained the process in a letter to Sir D. Brewster, and this picture was obtained by following his directions and using a temporary camera obscura made with a common small lens or burning glass an inch & a half in diameter – it is no doubt the first calotype portrait taken in Scotland – the sitting lasted nearly two minutes in bright sunshine –



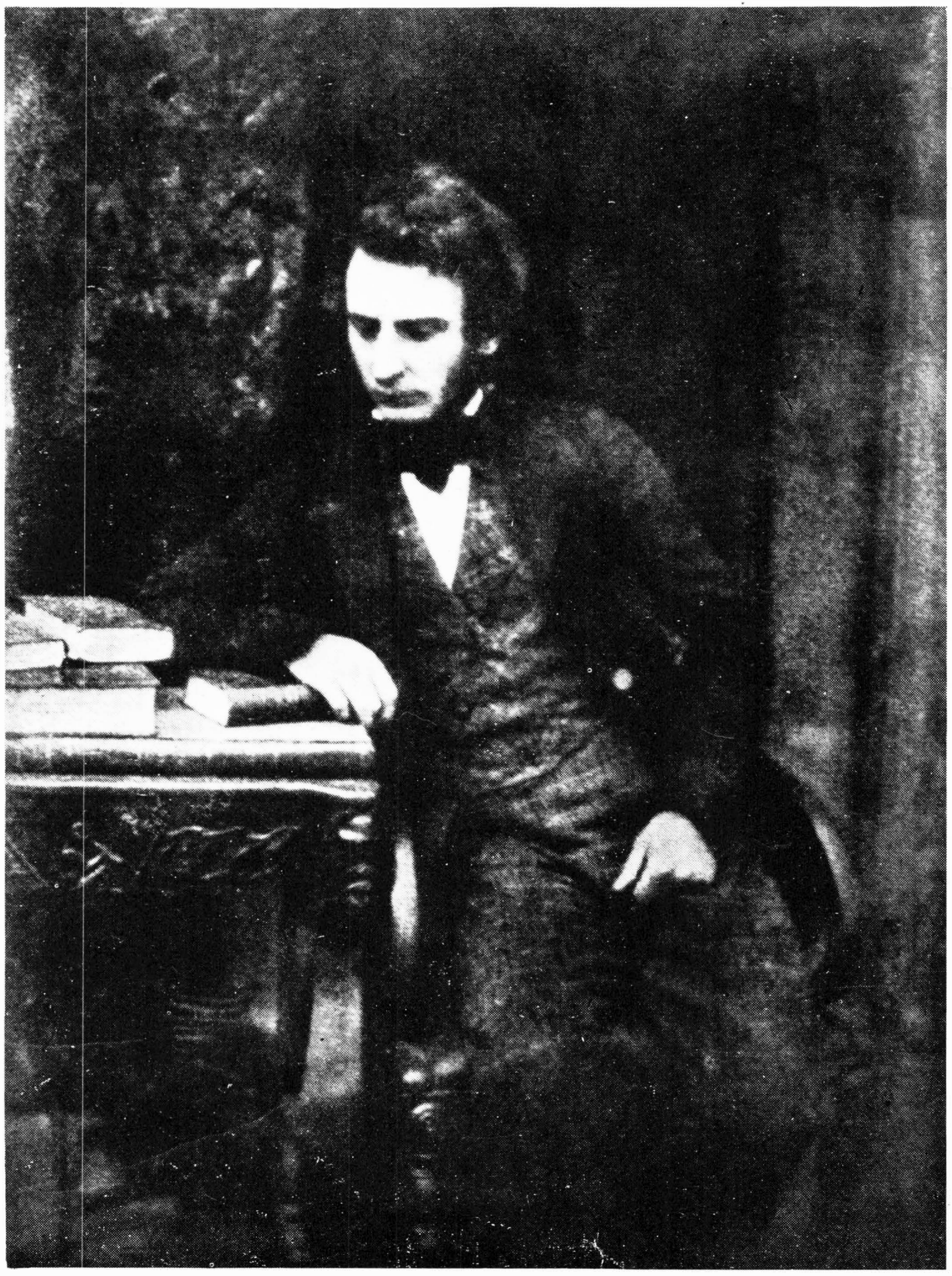
67 DR JOHN ADAMSON. Negative and positive calotype of an unknown lady, May 1841, and (above) inscription by Adamson

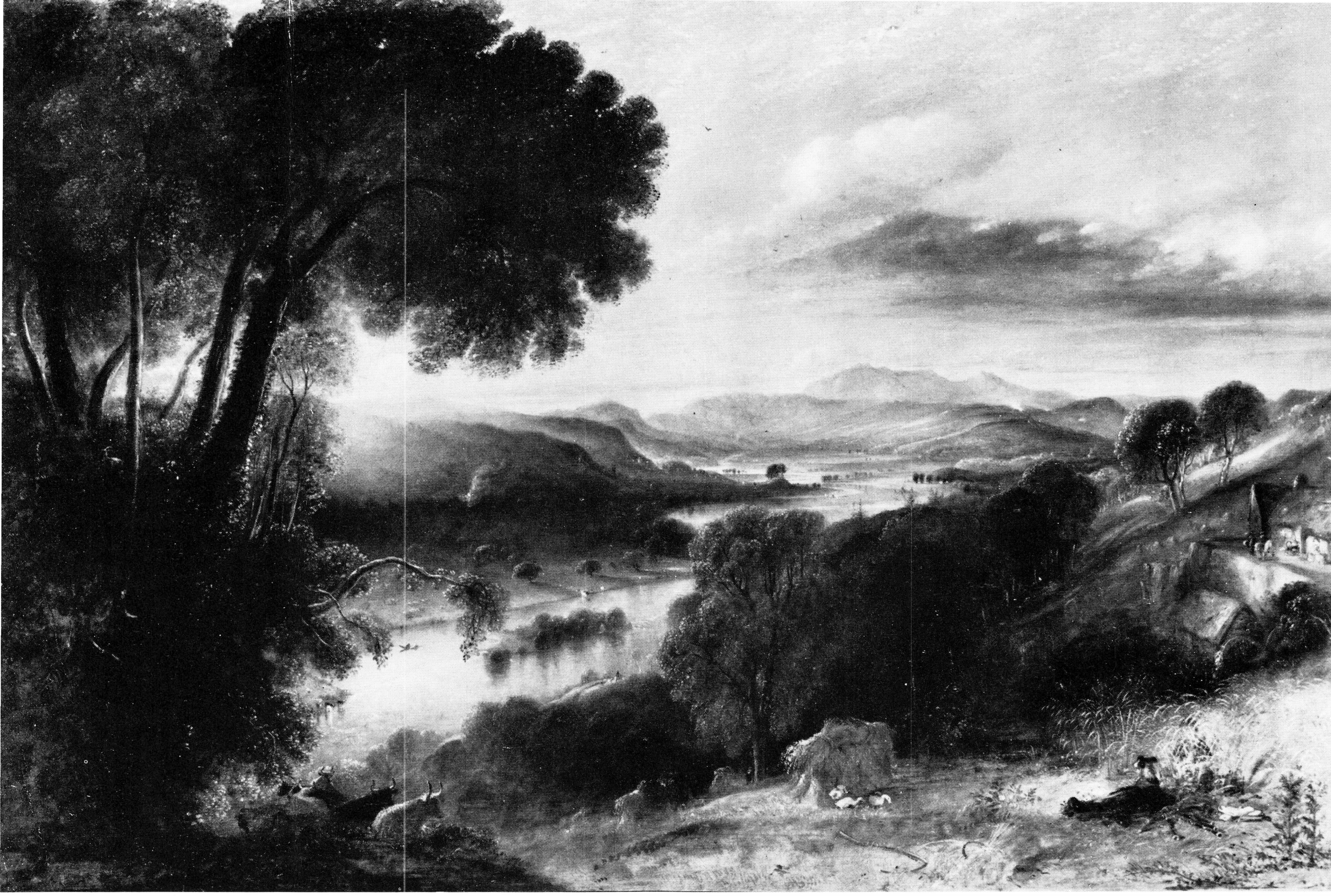
68 ROBERT ADAMSON. Calotype by D. O. HILL, *c.* 1843

69 DAVID OCTAVIUS HILL. Scottish landscape, oil painting 34¼ in. × 50 in., signed and dated 1852

70 D. O. HILL and ROBERT ADAMSON. Miss McCandlish. Calotype, *c.* 1843

71 DAVID OCTAVIUS HILL. Calotype by R. ADAMSON, *c.* 1843

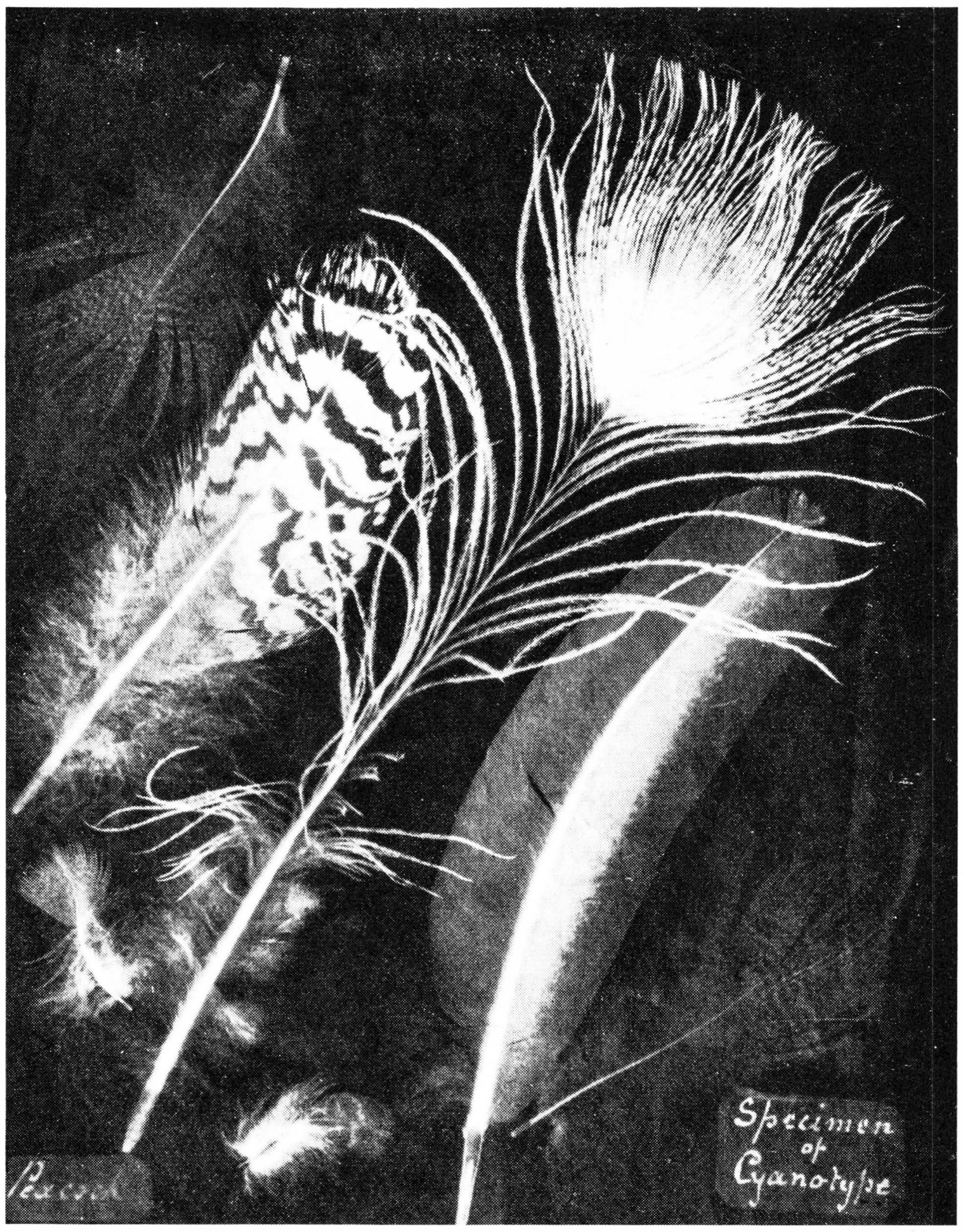


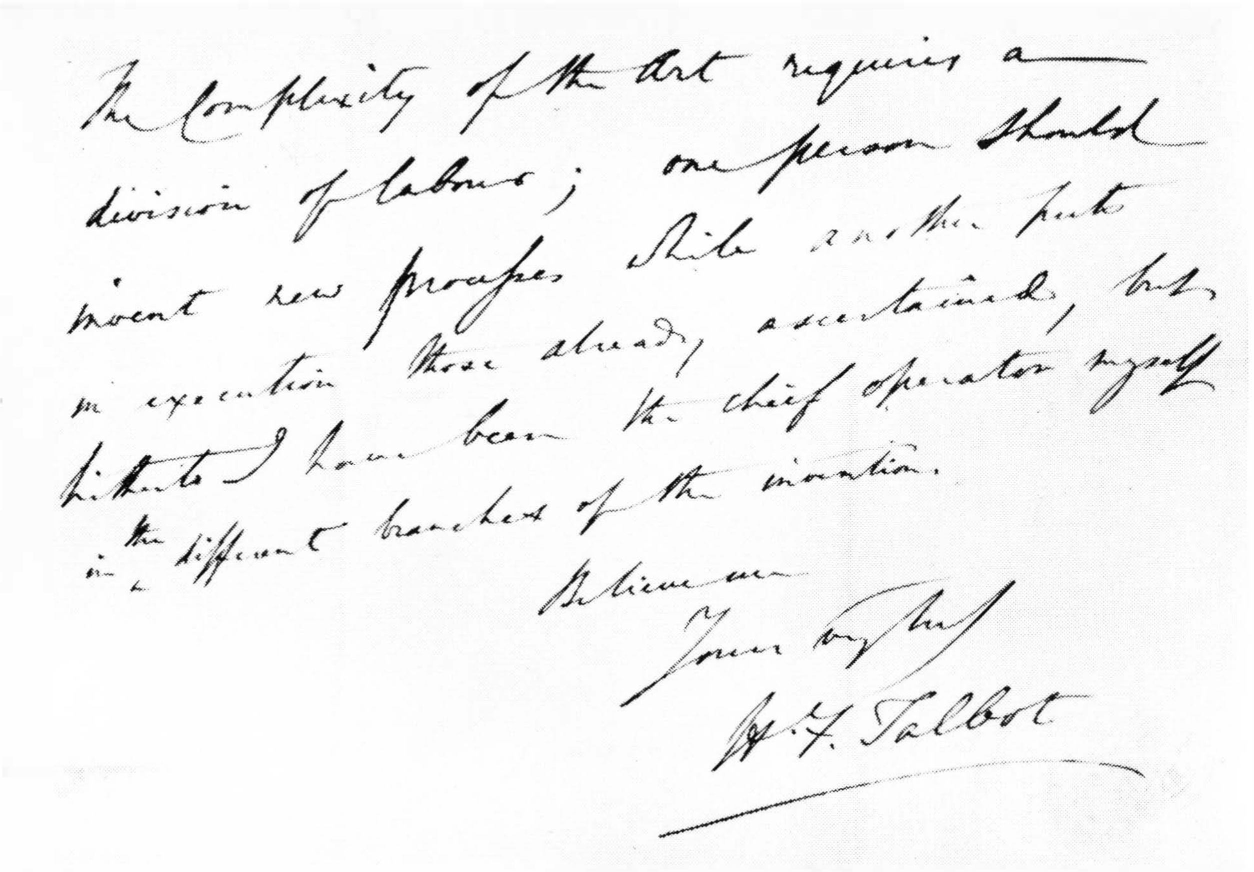


72 D. O. HILL and R. ADAMSON. John Stevens and bust. Calotype, 1843–5

73 D. O. HILL and R. ADAMSON. Lady Mary Ruthven. Calotype, *c.* 1845

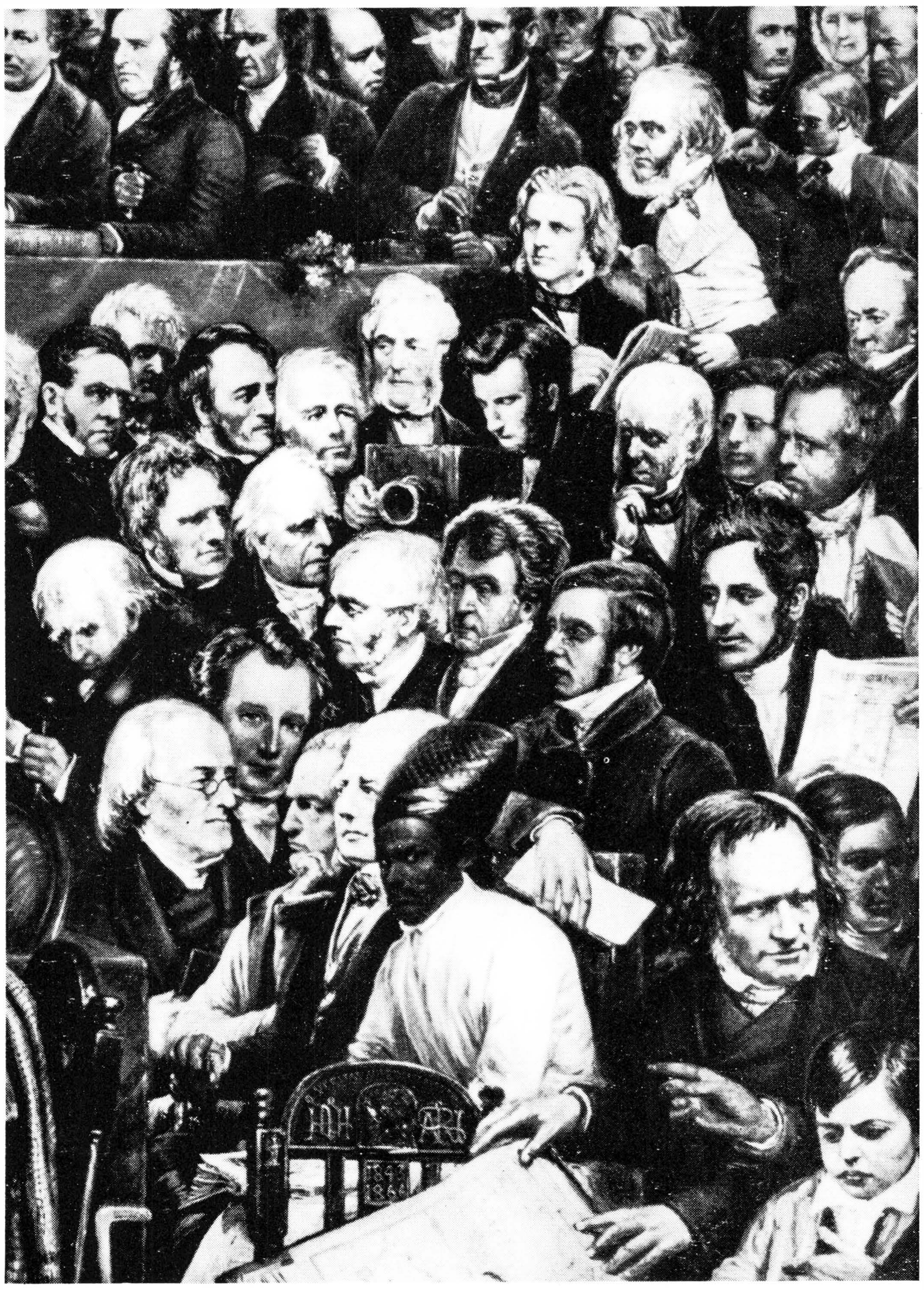
74 D. O. HILL and R. ADAMSON. Rev. James Fairbairn and Newhaven fishwives. Calotype, *c.* 1845





The Complexity of the Art requires a division of labour; one person should invent new processes while another puts in execution those already ascertained, but hitherto I have been the chief operator myself in the different branches of the invention.

Believe me
Yours very truly
H. F. Talbot

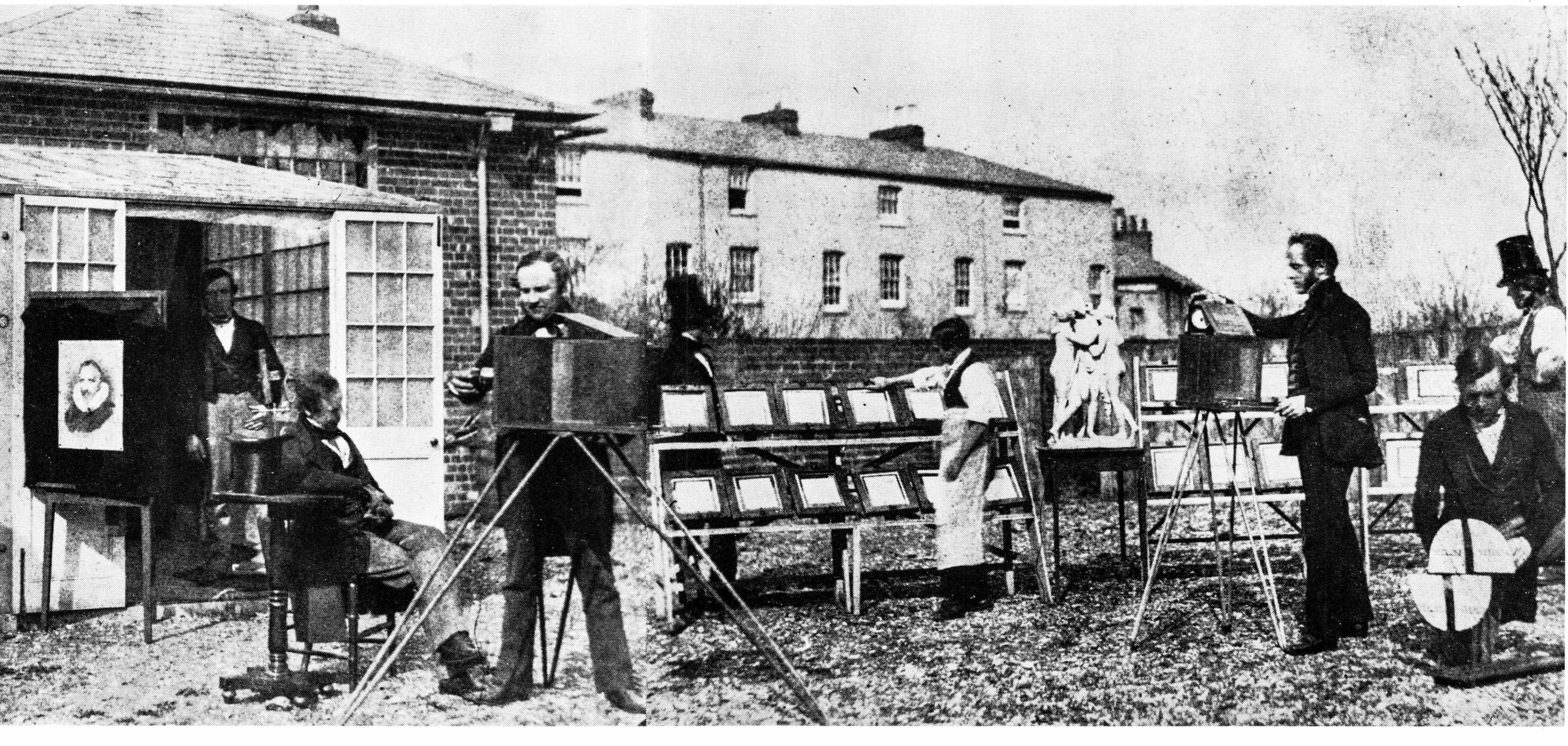


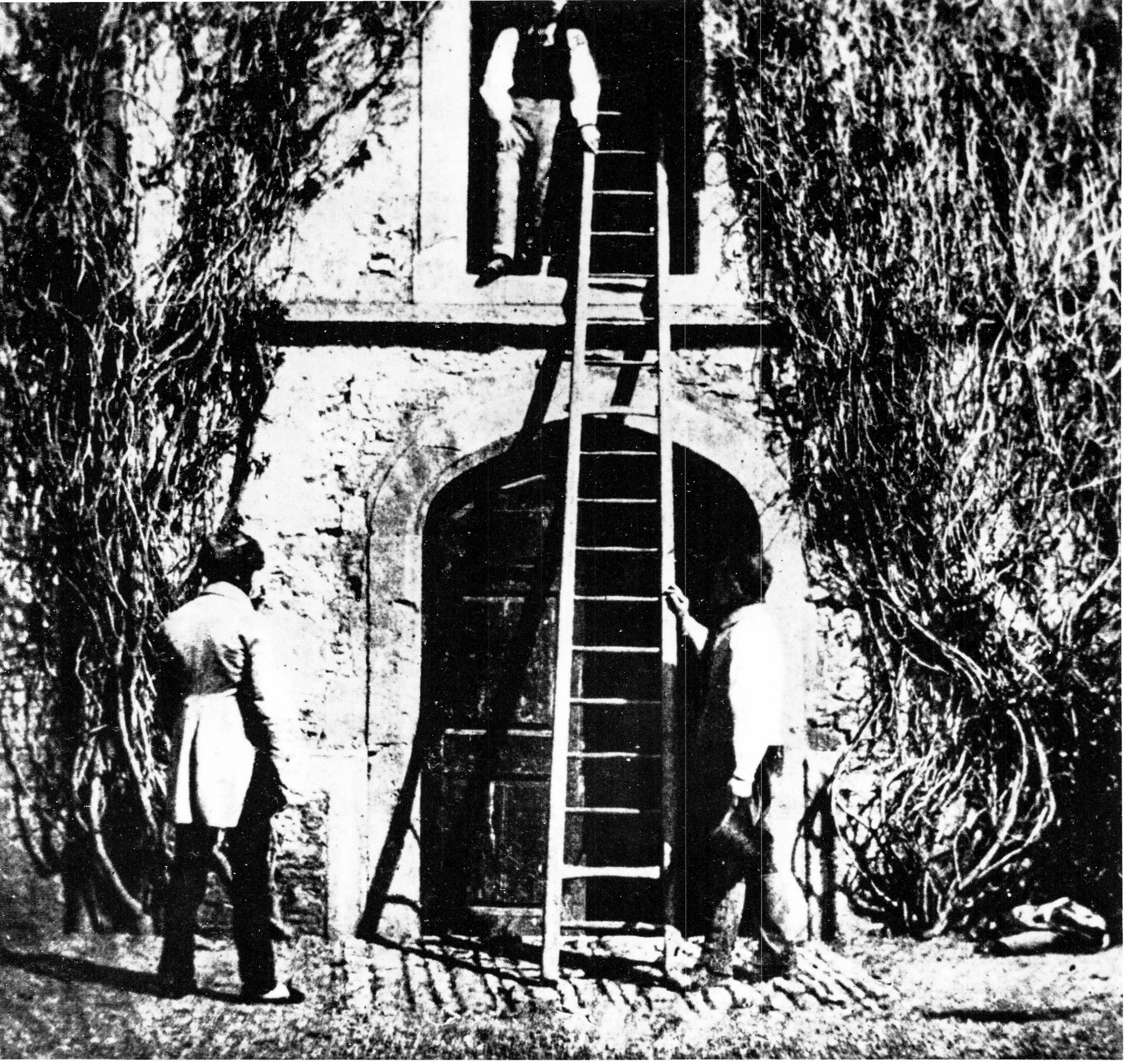
75 **SIR JOHN HERSCHEL**. Cyanotype of peacock feathers, 1845

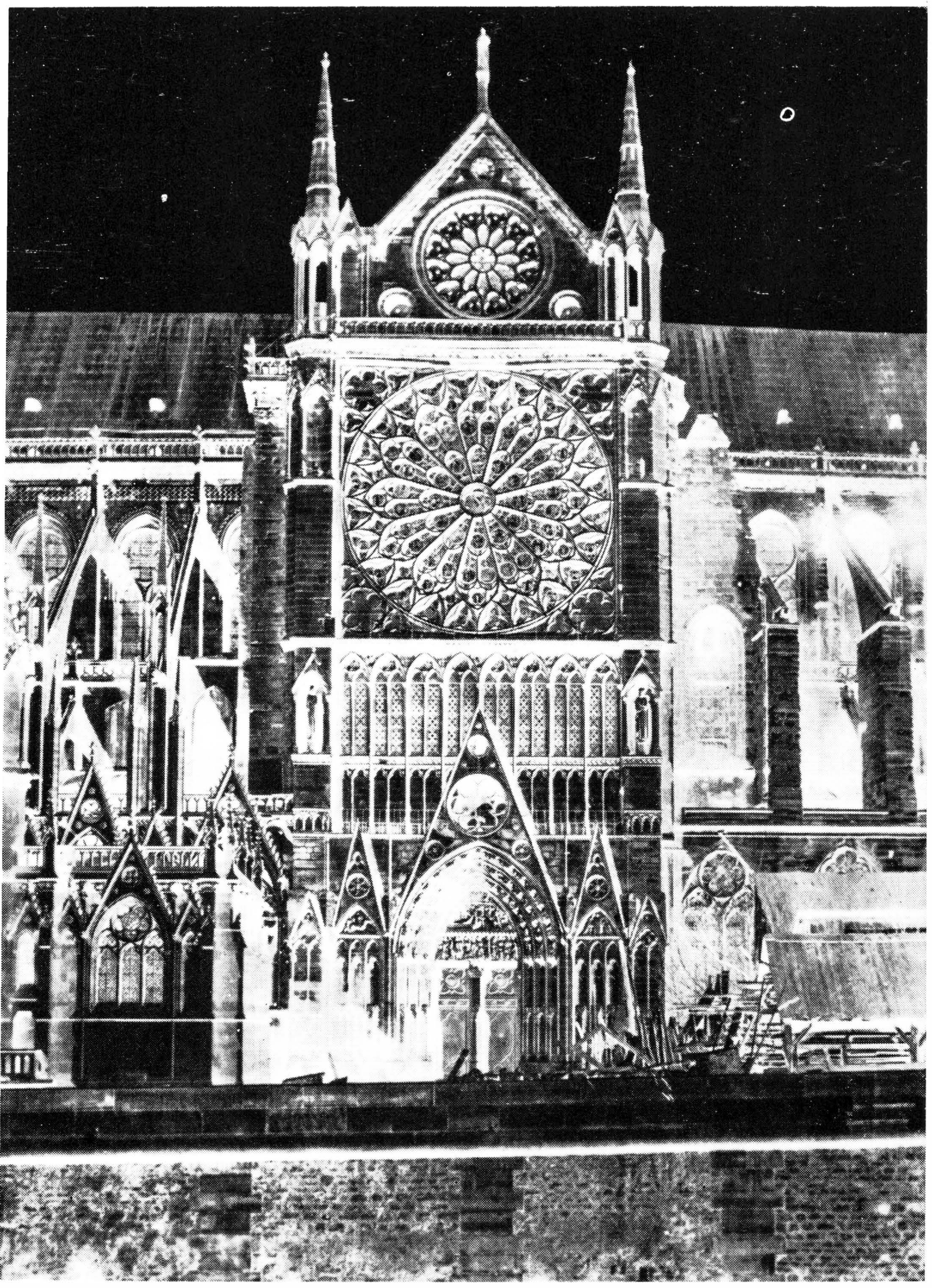
76 Letter from **FOX TALBOT** to the editor of the *Literary Gazette*, 23 June 1844

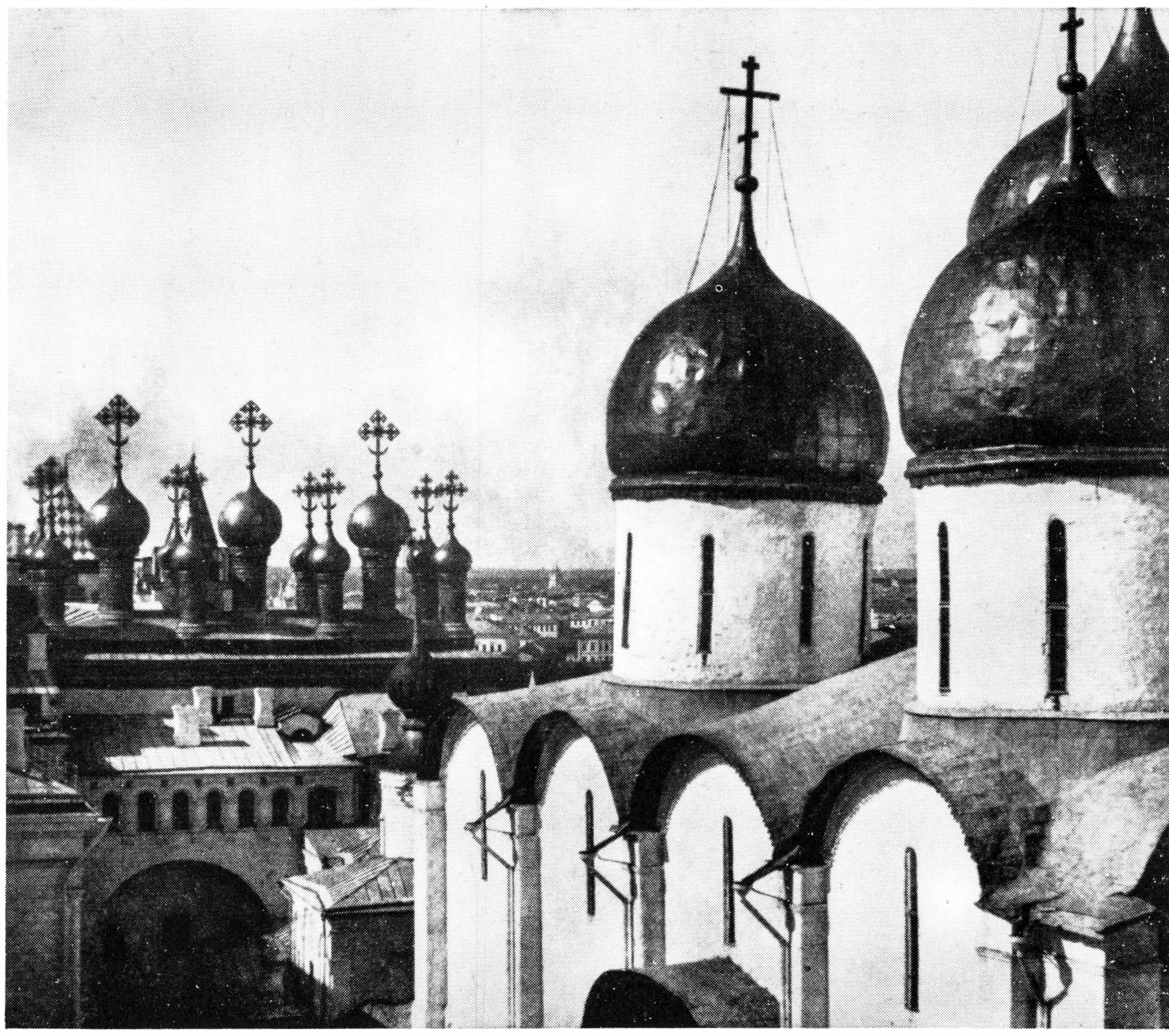
77 Detail from **D. O. HILL**'s painting *The Signing of the Deed of Demission*, completed 1866. Photo by **THOMAS ANNAN**. Carbon print

78 **TALBOT**'s photographic printing establishment at Reading, *c.* 1845









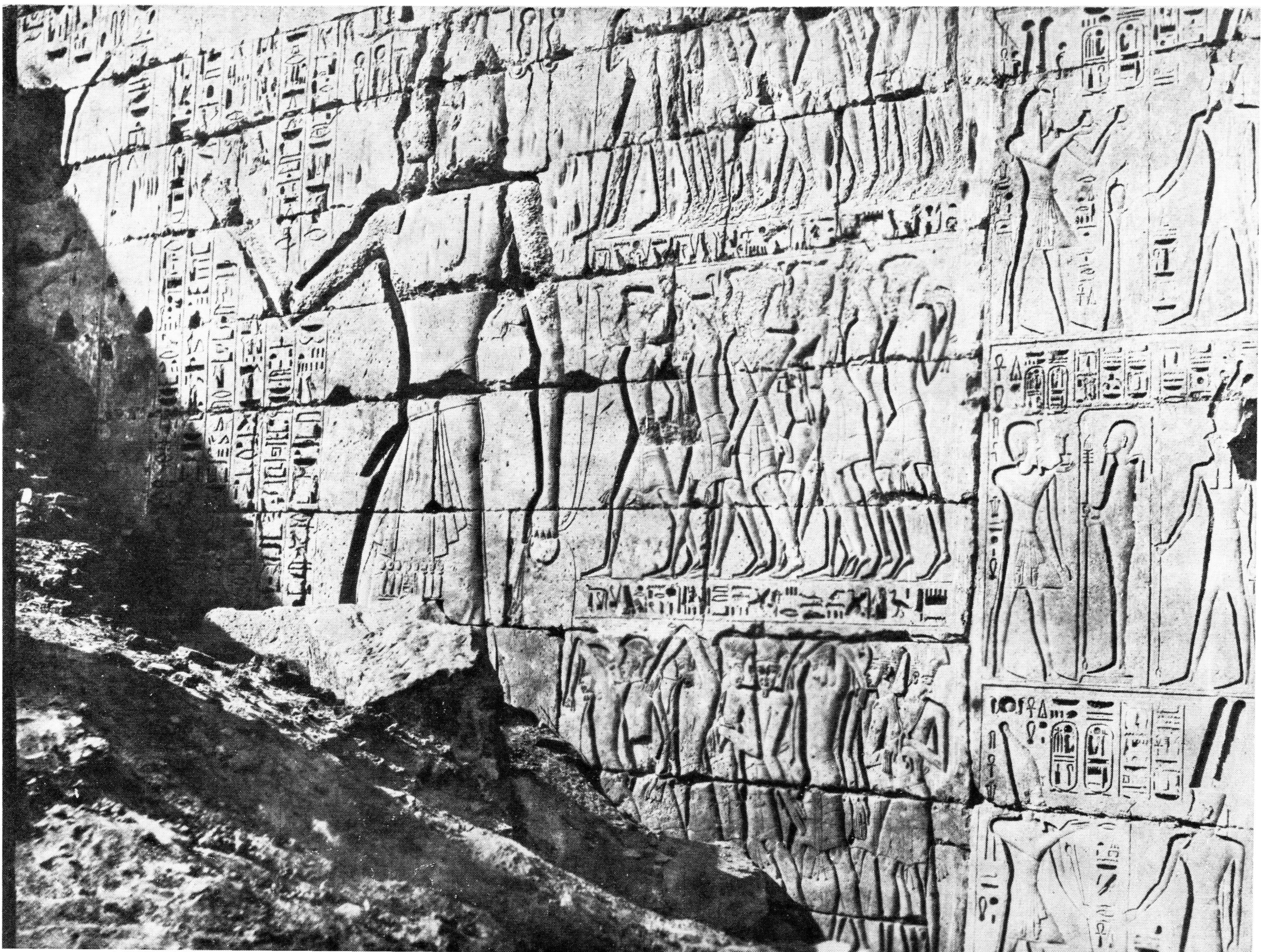
79 FOX TALBOT, 'The Ladder'. Calotype, 1844

80 FOX TALBOT. The cloisters at Lacock Abbey, with the Rev. Calvert Jones, 1843

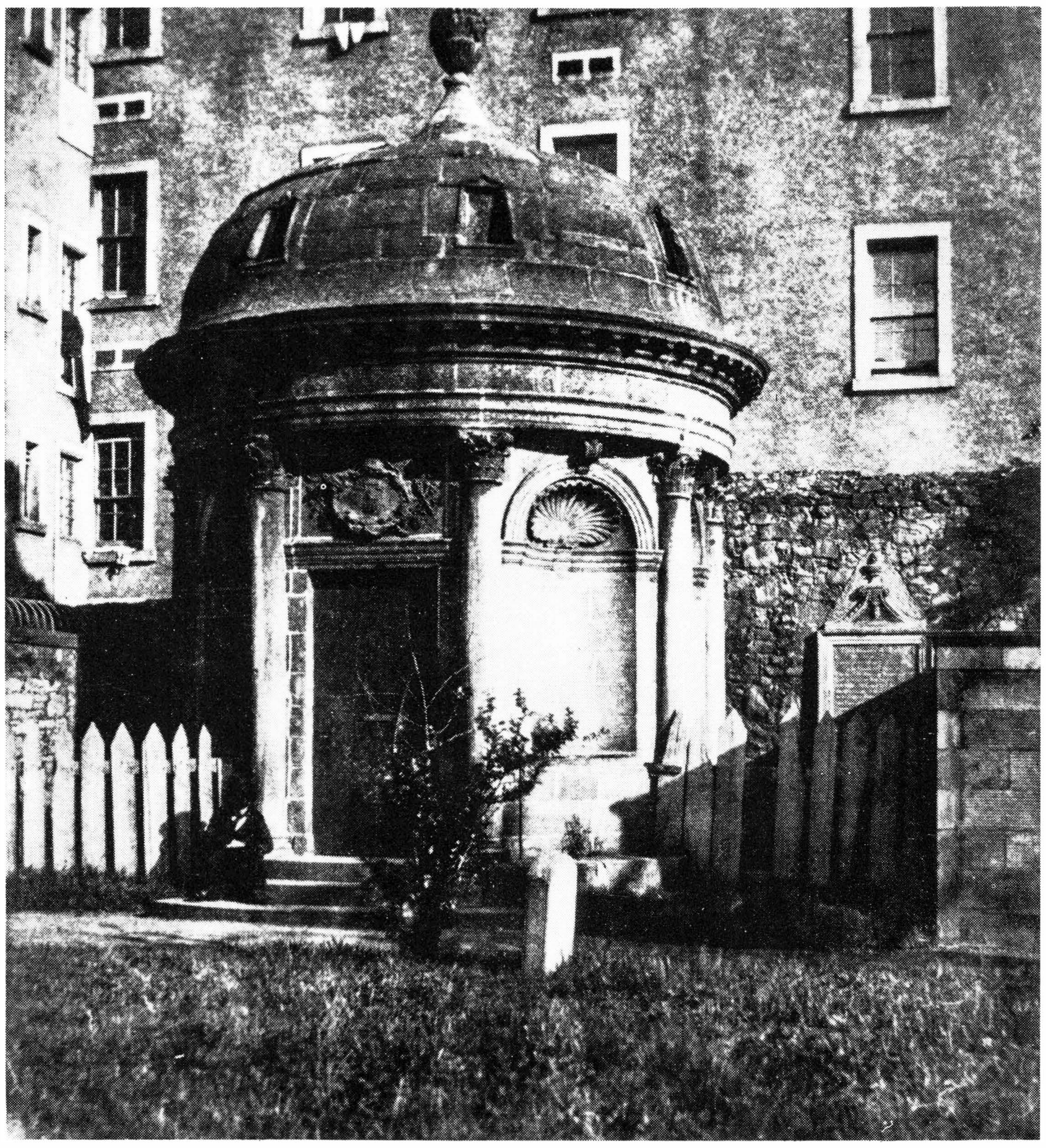
81 JOHN SHAW SMITH. Notre Dame, Paris. Calotype negative, 1850

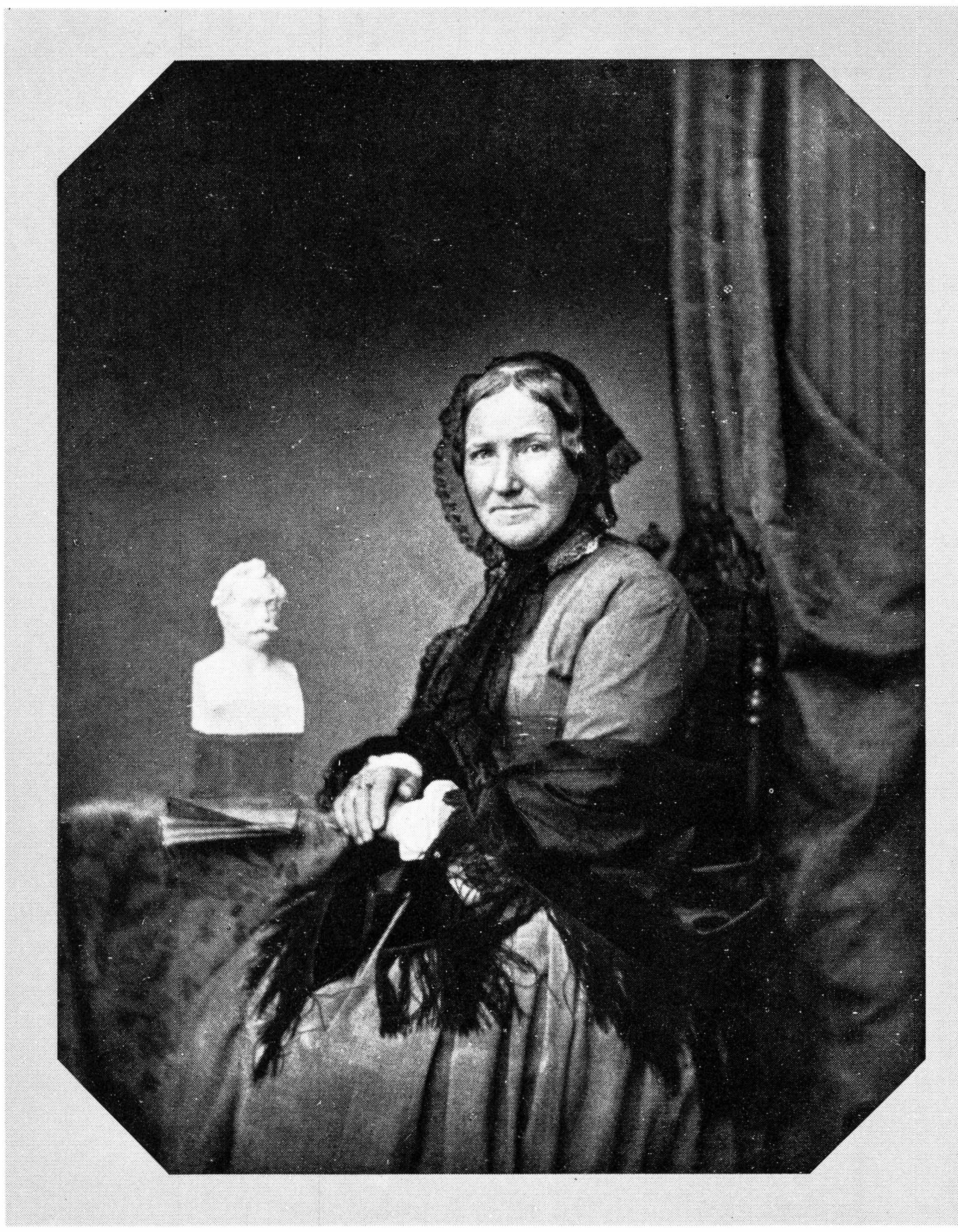
82 ROGER FENTON. Domes of the Cathedral of the Resurrection in the Kremlin. Waxed paper, 1852

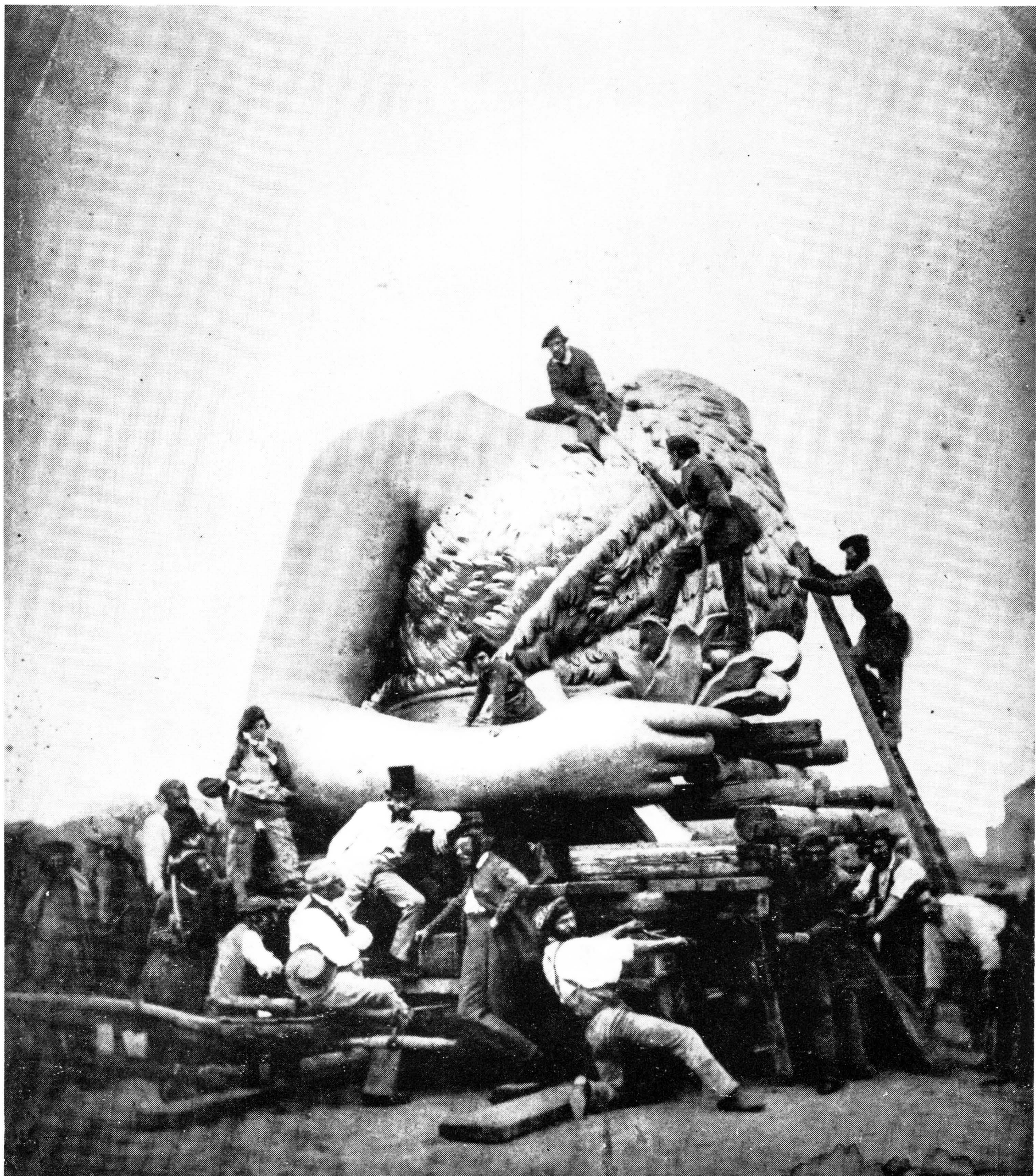
83 JOHN SHAW SMITH. Relief on temple at Thebes. Waxed paper, 1851



T. STORMONTH &
PLUMBERS, ZINC WORKERS, & GAS FITTER







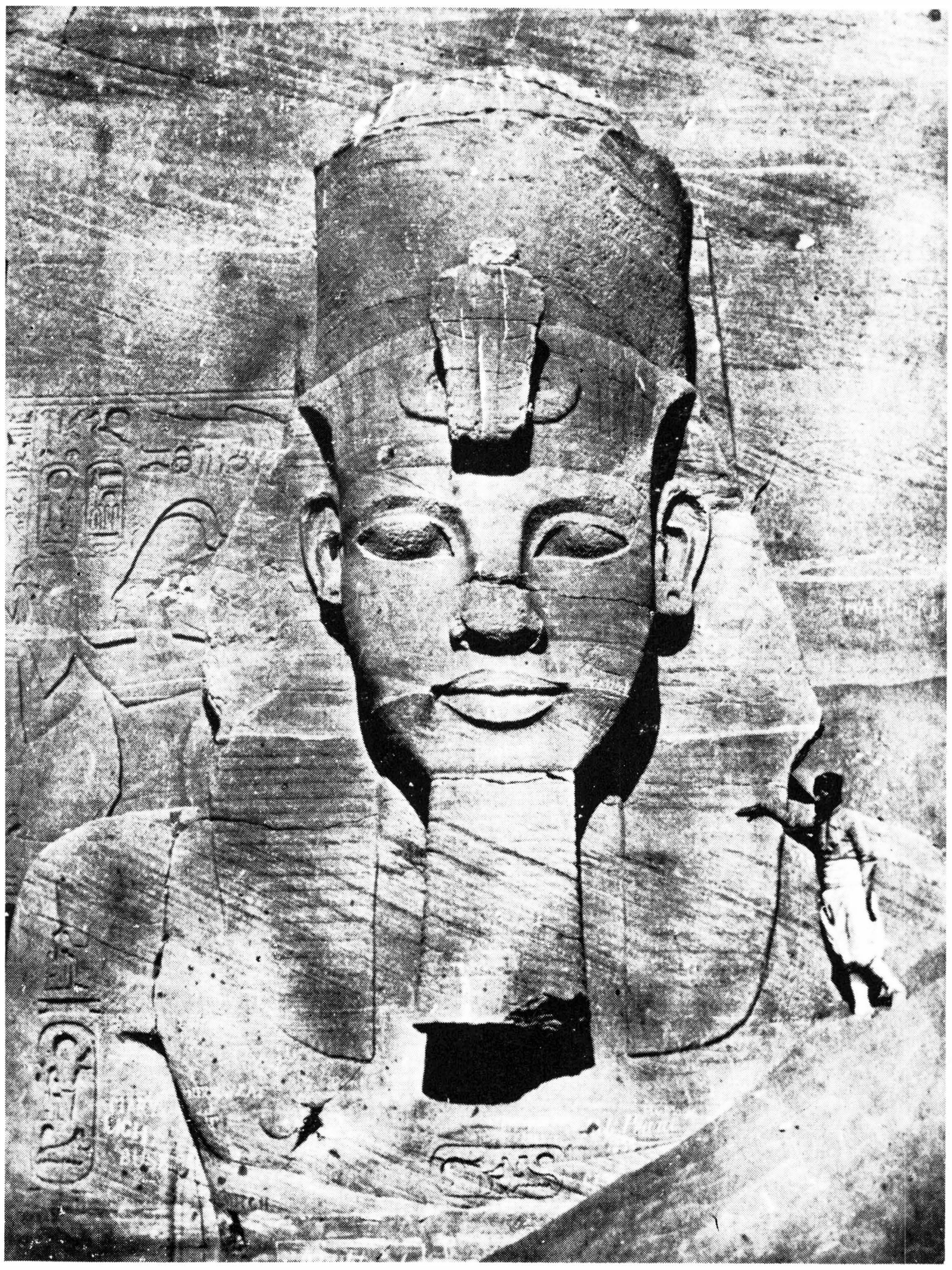
84 Unknown calotypist. Zeughausplatz, Berlin, with Crown Prince's palace on right, *c.* 1855

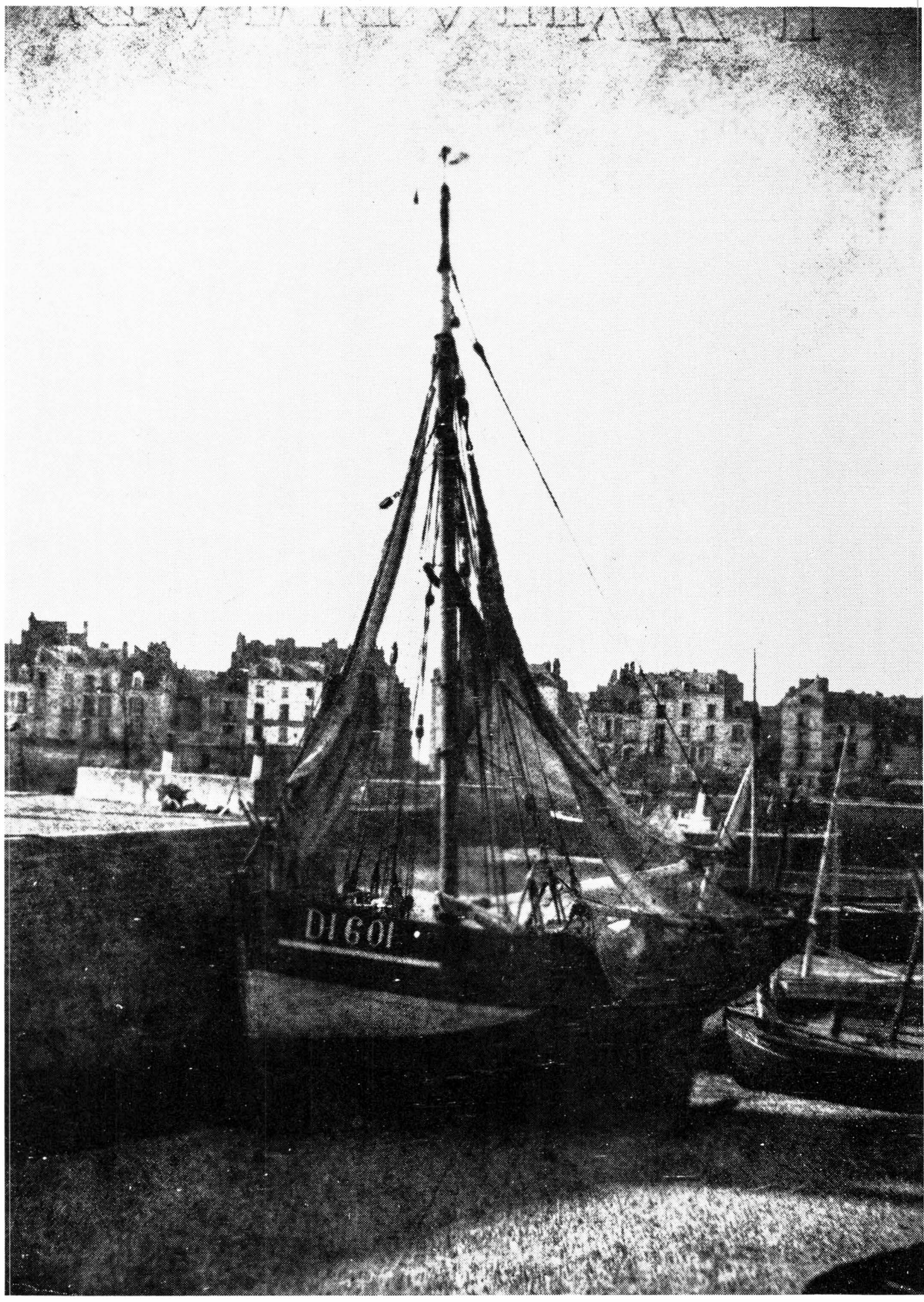
85 DR THOMAS KEITH. Old houses in Edinburgh. Waxed paper, *c.* 1855

86 DR THOMAS KEITH. The Mackenzie Tomb, Greyfriars churchyard, Edinburgh. Waxed paper, *c.* 1855

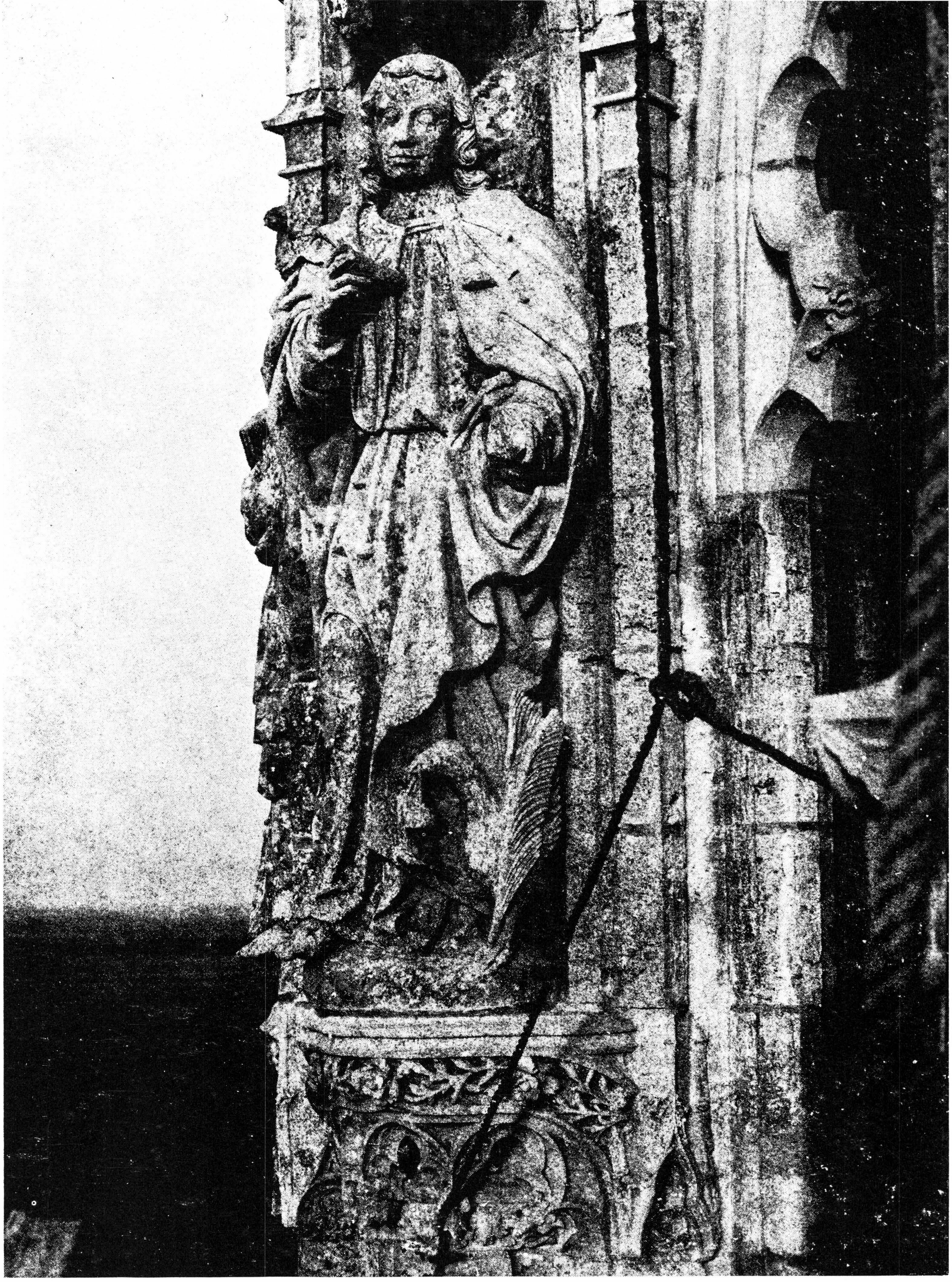
87 FRANZ HANFSTAENGL. Frau Schwanthaler, widow of the sculptor F. X. Schwanthaler. Calotype, *c.* 1855

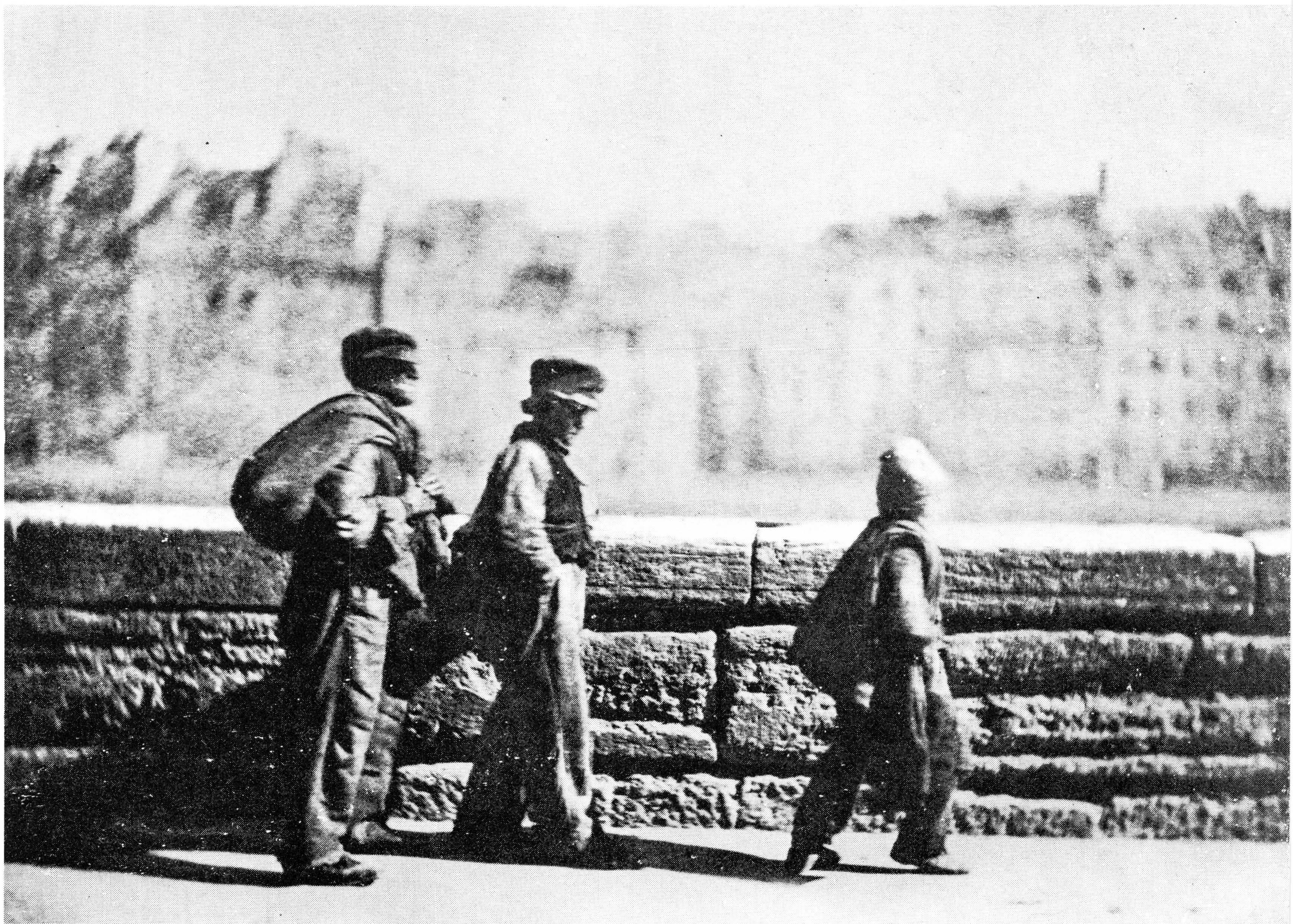
88 ALOÏS LÖCHERER. Transport of the colossal statue of 'Bavaria' from the foundry to its site in Munich. Calotype, 1850




DI 601

Les remparts d'Avignon
E Baldus





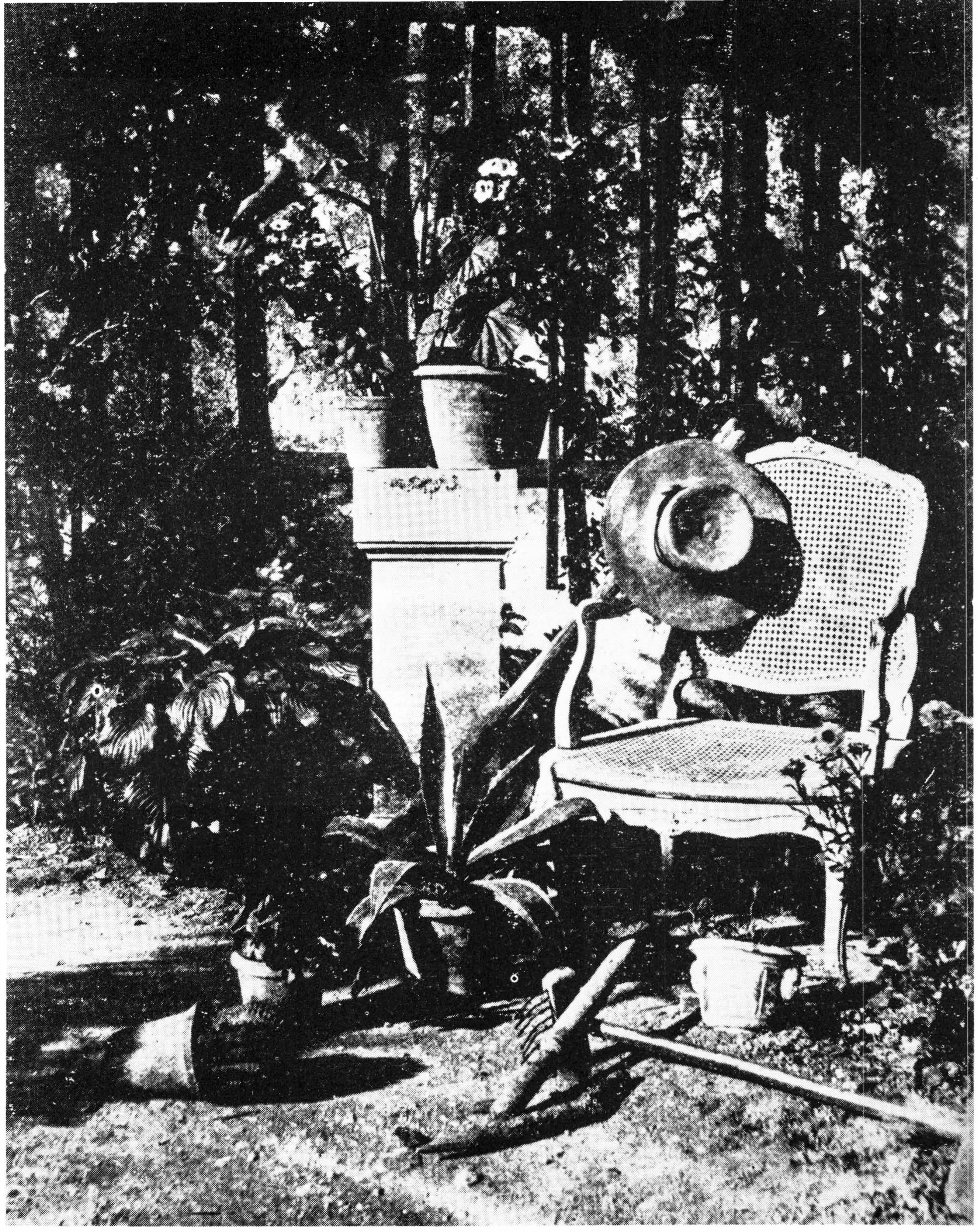
89 MAXIME DU CAMP. Colossus of Rameses II at Temple of Abu Simbel. Calotype, 1849–50

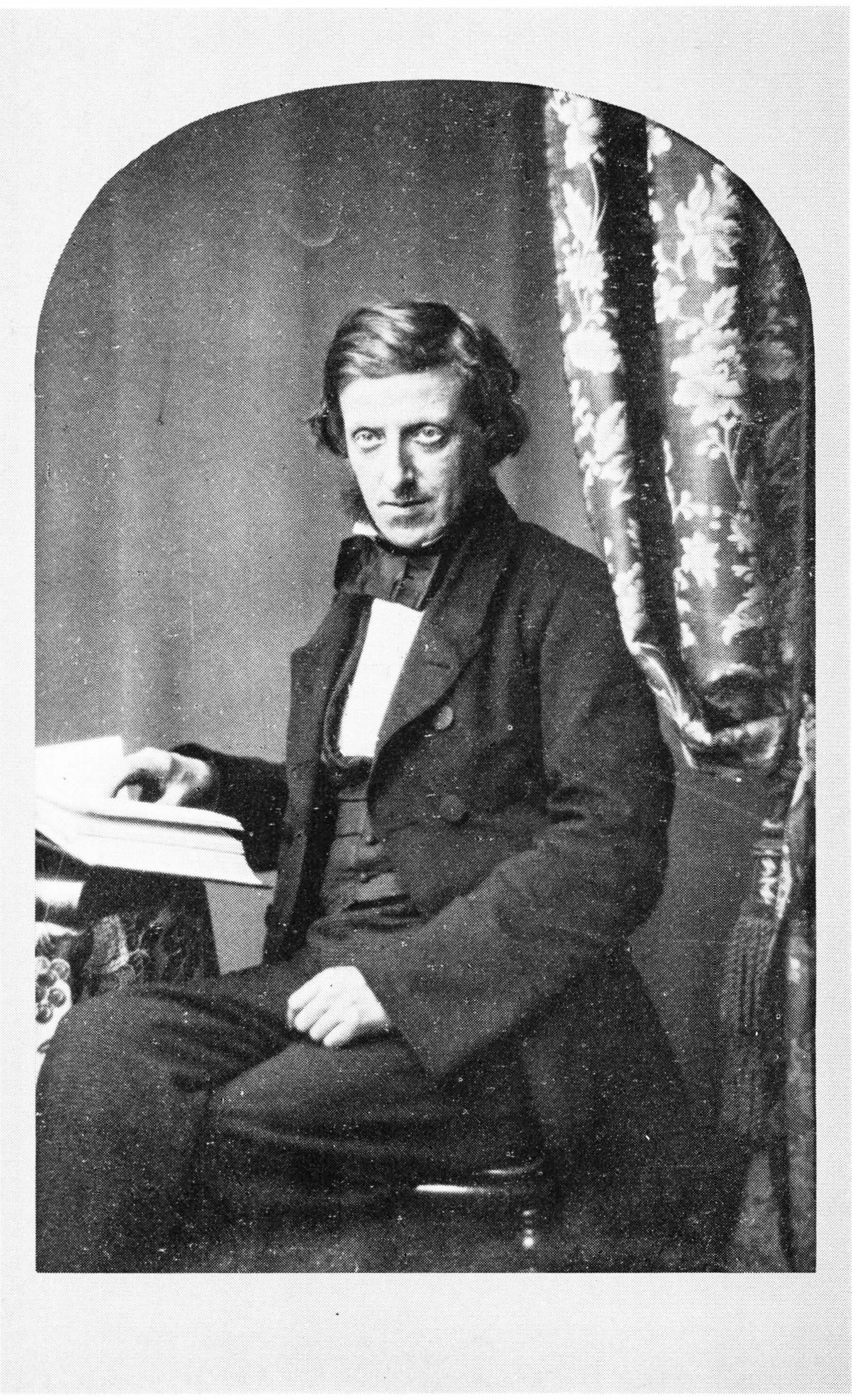
90 HENRI LE SECQ. Harbour scene. Waxed paper, *c.* 1852

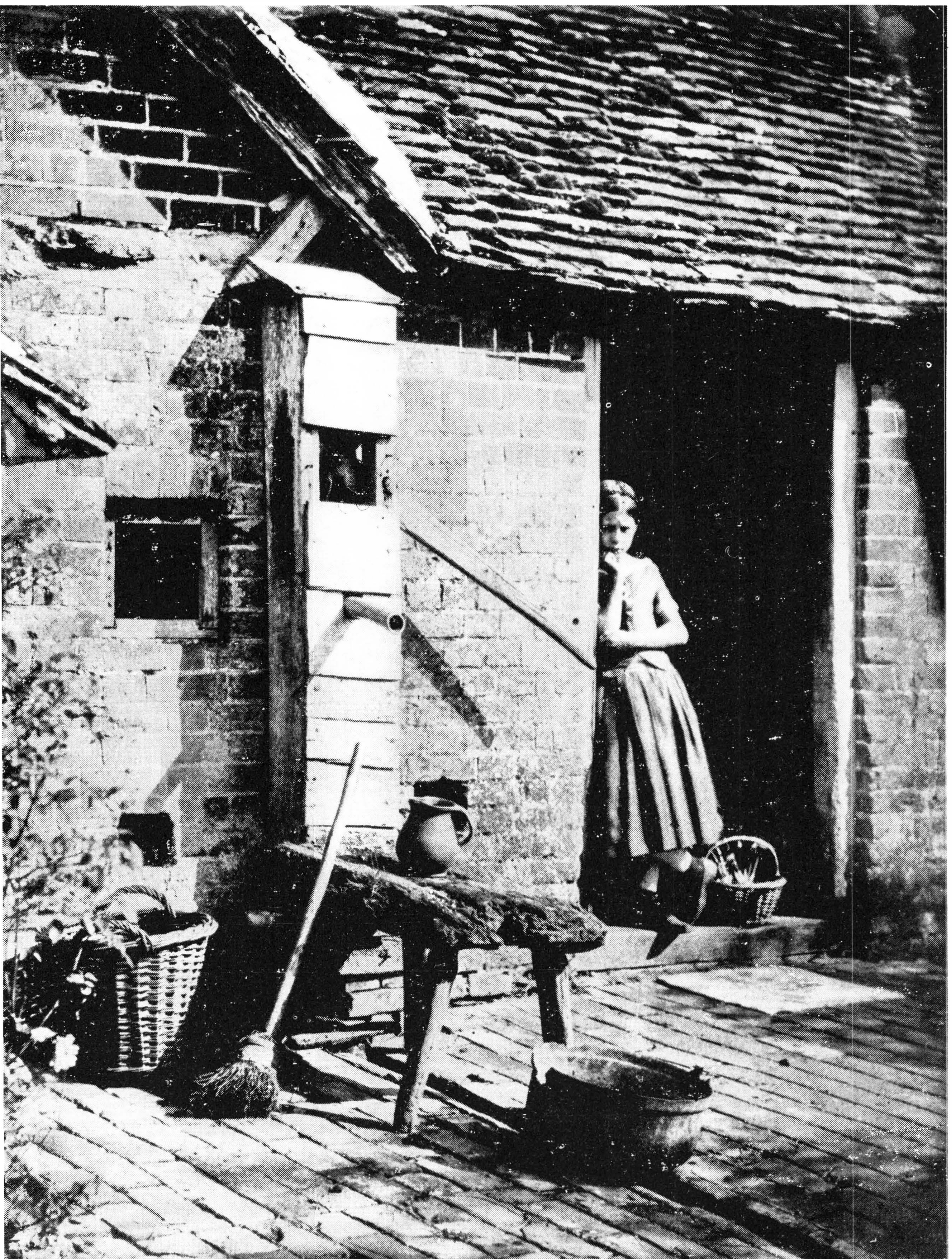
91 E. BALDUS. Ramparts at Avignon. Waxed paper, *c.* 1851

92 CHARLES NÈGRE. Gothic sculpture, St Gilles du Gard Abbey. Calotype, 1852

93 CHARLES NÈGRE. 'Les Ramoneurs' (chimney-sweeps, Paris). Waxed paper, 1852







94 HIPPOLYTE BAYARD. Garden scene. Albumen-on-glass, *c.* 1850

95 FREDERICK SCOTT ARCHER, ambrotype by R. Cade, 1855. Science Museum, London

96 HUMBERT DE MOLARD. Old farmhouse. Waxed paper, 1852

Part IV

THE COLLODION PERIOD

17 *The popularization of photography*

The relaxation of Talbot's patent in July 1852 and the almost simultaneous perfection of the collodion process made photography at last a really popular pursuit, and with mistaken ideas as to the ease of the new method large numbers of amateurs purchased the necessary apparatus. The demand for instruction was met by several institutions which, the following spring, started classes in all branches of the now fashionable hobby. T. A. Malone taught at the Royal Polytechnic Institution, Philip H. Delamotte at the Photographic Institution in New Bond Street, and Henneman at the newly formed Panopticon of Science and Art in Leicester Square. In this Moorish-style building, better known to Londoners as the old Alhambra Theatre, a lift took visitors up to the photographic saloon, said to be the largest at the time. It was over 54 ft long, 'enabling family groups of eighteen persons to be taken at once'. In addition, completely equipped private glasshouses could be hired by amateurs at a weekly rent. The charge for instruction was 5 guineas for six lessons.

The London School of Photography founded in 1854 at 103 Newgate Street, London, was confined neither to teaching nor to the capital. Its main business, the taking of portraits, expanded so rapidly that branch studios were opened in Regent Street, Oxford Street, Poultry in the City, and Myddleton Hall in north London, as well as in Church Street, Liverpool and Market Place, Manchester.

The following hints on exposure were given *gratis* by 'Poetus Photographicus', but this primitive 'exposure meter' must have been of doubtful utility:

Whene'er the wind is in the East,
Use twice the seconds at the least.
And if the East incline to North,
Take not the wretched sitter forth.
Come cloud electric, or of hail,
Then every picture's sure to fail.
But with light zephyrs from the West,
In scarce five seconds 't is imprest:
And if the West incline to South,
In three you have eyes, nose and mouth.[1]

Photography was taught to the Royal Engineers at Chatham from 1856 and later at Woolwich and other military and naval establishments; architects and engineers found it invaluable for recording the progress of their undertakings, and so did medical men for the recording of diseases and the study of lunacy; scientists applied photography to many specialized fields, such as astronomy, meteorology, and microscopy; and though the basis for all these applications had been laid in the

NORFOLK EDUCATION COMMITTEE
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KING'S LYNN.

daguerreotype and and calotype period, with the much faster collodion plate they became much more widespread and general.

The University of London, recognizing that photography was one of the educational needs of the time, introduced it into the curriculum at King's College in December 1856. A large glasshouse and darkrooms were erected, and T. F. Hardwich, author of the first manual of photographic chemistry (1855), was appointed lecturer.

Even Queen Victoria and Prince Albert had a darkroom constructed at Windsor Castle, and became skilled in 'the black art' (so called because the nitrate of silver bath caused black stains on hands and clothes of a careless operator), in which they had already shown their interest by becoming patrons of the Photographic Society within four months of its foundation. How infectious the craze was is shown by the Queen's gift of a photographic outfit to the King of Siam. In December 1857 she sent the Empress Eugénie as a New Year present an album of photographs of her children and Windsor Castle, taken by Roger Fenton. Lady Eastlake, wife of the Society's first President, summed up vividly her impressions of the new state of affairs:

> Tens of thousands are now following a new business, practising a new pleasure, speaking a new language, and bound together by a new sympathy. For it is one of the pleasant characteristics of this pursuit that it unites men of the most diverse lives, habits, and stations, so that whoever enters its ranks finds himself in a kind of republic, where he needs apparently but to be a photographer to be a brother. . . . The very talk of these photographers is unlike that of all other men, either of business or pleasure. Their style is made up of the driest facts, the longest words, and the most high-flown rhapsodies. Slight improvements in processes, and slight variations in conclusions, are discussed as if they involved the welfare of mankind. They seek each other's sympathy, and they resent each other's interference, with an ardour of expression at variance with all the sobrieties of business and the habits of reserve; and old-fashioned English *mauvaise honte* is extinguished in the excitement, not so much of a new occupation, as of a new state.[2]

Several more photographic societies were founded in London and in the provinces, and by 1861 two dozen had been established. The most exclusive of these was the Amateur Photographic Association, founded in September that year. Indeed, the success of the Association, which flourished for forty-four years, was said to have been largely due to the Presidency of the Prince of Wales, who, perhaps more than photography, was the rallying point in this Association, which included among its members the Archbishop of York, several peers, Fellows of the Royal Society, and the chief cashier of the Bank of England. The Honorary Secretary of the Association (to which professional photographers were not eligible as members) was A. J. MELHUISH, inventor of the roller-slide. A grand soirée of the Association took place in February 1865 at his private residence in York Place, Baker Street, which was attended by the Prince of Wales and about 400 members and guests.[3] Everything was arranged on the most lavish scale: 1,000 photographs were on view, champagne flowed, and Rimmell's celebrated perfume-fountain, 'which had first graced the bridal chamber of the Princess of Wales at Osborne, imparted an agreeable fragrance to the crowded rooms.'

Examination of the number of photographs shown at the three leading exhibitions in January 1857 affords an interesting comparison not only of the numbers hung, but also of the relative popularity of the different processes. At the Photographic Society of London, 726 photographs were displayed; at the Manchester Photographic

Society, 684; at the Photographic Society of Scotland, Edinburgh, 875. Analysing their contents, and supposing the number of photographs to be 1,000 in each case, we find the following proportions:

	Collodion	*Waxed paper*	*Calotype*	*Albumen*	*Dry collodion*	*Portraits*
London	825	66	41	8	60	170
Manchester	649	200	111	30	10	87
Edinburgh	600	51	232	70	47	280

This table shows some surprising regional differences. Manchester had three times as many waxed-paper pictures as London; Edinburgh nearly six times as many calotypes as London. In the albumen process the gulf between London and Edinburgh was still wider. The large number of calotype and albumen pictures in Edinburgh is clearly a result of the freedom Scottish photographers had enjoyed from Talbot's patent; naturally, they were slower to change over to collodion from the processes they had been using for years. None the less, the figures indicate better than words the extent to which collodion had superseded all other processes by the end of 1856.

In hanging the pictures the photographic societies followed the example set by the Royal Academy. Quantity being the directive, the frames were crowded from floor to ceiling, and 'many excellent pictures were so placed as to necessitate the ungraceful attitude of "all-fours" to obtain a satisfactory view of them'. This inartistic arrangement persisted up to the end of the century. Pl 101

18 *Portrait photography – a new industry*

The remarkable rise of professional photography after the *Talbot* v. *Laroche* case is best illustrated by a few statistics. In the census of 1841 photography does not appear as a profession. Ten years later, only 51 photographers were recorded; in 1861 there were 2,879. Whilst in 1851 Miss Wigley was the only woman professional, ten years later there were 204. In Paris there were no fewer than 33,000 persons in 1861 who made their living from photography and allied trades.[1]

In 1841 there were only three portrait establishments in London; in 1851 there were about a dozen; in 1855, 66; in 1857, 155; and in 1861 over 200, of which 35 were crowded into Regent Street (not to mention the legion of cheap traders who had sprung up by then). In 1866 there were 284 studios in London. 'Glasshouses' were a new feature of the London skyline. 'Scarcely a favourable spot for the practice of the art is left untenanted', runs the report of the jury on photography at the International Exhibition, 1862. Every town of note, and even some villages, boasted one or more photographers, and travelling photographic vans made the round of outlying country districts.

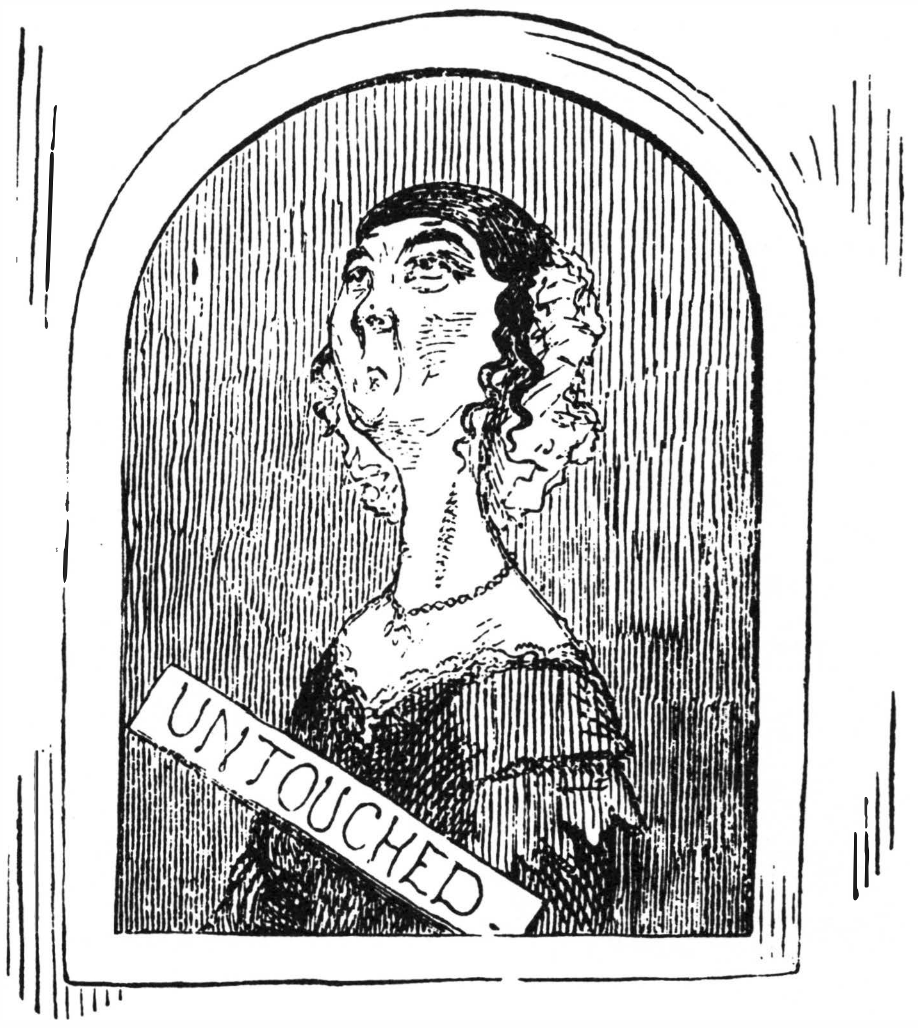
While amateurs chiefly concentrated on landscapes, town views, and architecture, portraiture remained almost exclusively in the hands of professionals, though there was no certain or clearly defined division between amateur and professional: many so-called amateurs sold their views through print-sellers, and a number of the professionals carried on their original occupation concurrently.

By the mid-1850s portrait photography had almost completely supplanted miniature painting, and in 1859 for the first time no miniatures were shown at the Royal Academy exhibition. The gradual falling off since 1841 in the demand for miniatures now reached its lowest point and was not without influence upon portrait photography, for the public, accustomed to flattering portraits from painters, expected photographers to conform to the practice of painters. Since it was a common complaint that the camera represented the countenance too truthfully, it became the general practice to remove blemishes and add points of beauty lacking in nature, by retouching. The public's notions of refinement could not be satisfied without the obliteration of what was characteristic and true. It may be legitimate to hide defects by skilful posing and lighting, but 'beautifying' can only be done by manual interference with the negative or print, and the photographer then leaves his proper domain of drawing with light and becomes that curious hybrid the painter-photographer.

In the late 1850s retouching and 'beautifying' were carried to such extremes that some photographic societies banned coloured photographs altogether from their exhibitions and in the case of touched-up photographs often stipulated that the negative should be exhibited alongside the print. Fig 26 Indeed, the ease with which anyone with a little skill could add to or take away from parts of the picture, presented a dangerous temptation to photographers to give way to the sitter's desire for a flattering portrait, or to obtain 'artistic' effects. 'The colorist', ran one instruction, 'may correct with his brush defects which, if allowed to remain, spoil any picture. For instance, where a head is so irregular in form as to become unsightly, soften those features which are the most strikingly deformed, and reduce the head to a greater semblance of beauty. Try to discover what good points there are–for all heads have some good points–and give these their full value.'[2] In his aspirations towards the Victorian ideal the photographer would try to make his sitter's features conform to some such description as the following (with what result, may be left to the imagination):

> (*For women*). A handsome face is of an oval shape, both front view and in profile. The nose slightly prominent in the centre, with small, well-rounded end, fine nostrils; small, full, projecting lips, the upper one short and curved upwards in the centre, the lower one slightly hanging down in the centre, both turned up a little at the corners, and receding inside; chin round and small; very small, low cheekbones, not perceptibly rising above the general rotundity. Eyes large, inclined upwards at the inner angles, downwards at outer angles; upper eyelids long, sloping beyond the white of the eye towards the temples. Eyebrows arched, forehead round, smooth and small; hair rather profuse. Of all things, do not draw the hair over the forehead if well formed, but rather up and away. See the Venus de Medici, and for comparison see also Canova's Venus, in which latter the hair is too broad.
>
> (*For men*). An intellectual head has the forehead and chin projecting, the high facial angle presenting nearly a straight line; bottom lip projecting a little; eyebrows rather near together and low (raised eyebrows indicate weakness). Broad forehead, overhanging eyelids, sometimes cutting across the iris to the pupil.[3]

As to the most important part of the woman's figure, the waist, one instruction interpreted photography rather generously: 'The retoucher may slice off, or curve the lady's waist after his own idea of shape and form and size.'



PHOTOGRAPHIC TRUTH.
SKETCHED FROM A CASE OF SPECIMENS.

Fig 26 Cartoon from 'Punch', 1857

Portrait photographers did a good business in the mid-1850s but the days of vast fortunes from photography were still to come. Fashionable West-end photographers charged a guinea for a whole plate (8 in. × 6 in.) portrait, plain; 3 guineas for the same size, coloured; and 5 guineas for a larger size, coloured. Charges by Maull & Polyblank, a reputable firm in the City founded in 1854, were considerably less. For plain photographs any size up to 8 in. × 6 in., half a guinea; two figures in the same picture 18*s*., three figures in the same picture £1 5*s*., any additional person 5*s*. Children under ten years of age were charged double because of the trouble they gave. Colouring was extra.

	one person			*each additional person*		
Tinting face and hands	£1	1	0		10	6
Tinting face, hands, dress and background	£2	2	0	£1	1	0
Fully painted in oil or water colours	£3	3	0	£1	11	6
Stereoscopic portraits	£1	1	0			

These charges did not include framing or mounting.

THE AMBROTYPE, 1852–*c.* 1863

This is a particular adaptation of the collodion process which Archer worked out with a fellow member of the Calotype Club, PETER W. FRY. They found that by subjecting a collodion negative to a bleaching operation with nitric acid or bichloride of mercury, the blackened silver iodide was transformed into white metallic silver, and the negative image could be converted into a seemingly positive one when viewed by reflected light against a dark background. When seen by transmitted light, or without a dark background, the picture retains its negative character. Naturally, almost any negative on glass (or film) will exhibit this phenomenon even without a special bleaching process; it had been observed by Sir John Herschel in 1839, and led Talbot ten years later to call his albumen-on-glass pictures 'Amphitypes'.

Slightly under-exposed or under-developed negatives gave the best results, as a film of greater density tended to detract from the positive effect. A curious feature of the process was that the picture could be changed back if desired into a dark-toned negative by immersing it in a weak solution of ammonia, but this had no practical value, as the negative image was too thin to lend itself to the printing of positives.
Pl 100 When the bleached picture is backed with black velvet, black paper, or an opaque varnish, it assumes somewhat the appearance of a daguerreotype, without the disadvantage of the reflections from the polished silvered surface. Like daguerreotypes, these glass portraits are laterally reversed, but this could be obviated by laying the picture face downwards on the black paper or velvet. Ambrotypes, too, could not be multiplied. They were made in the same sizes as daguerreotypes, were also often hand-tinted, and were fitted in to similar cases. For this reason the two types are often confused, especially as the picture is always protected by a covering glass and sealed against dust with a tight pinchbeck frame; yet the bright mirror-like surface of the daguerreotype is distinctly different from the dull grey appearance of the ambrotype. Particularly attractive are the so-called 'Union' cases which were imported from America. They were of plastic moulded in elaborate designs, and in themselves have now become collectors' items. Patented by Samuel Peck in October 1854, these cases represent the first use of plastics in industry.[4]

The first publication of a method of making collodion positives appeared in *The Art Journal* in July 1851 in a communication from Fallon Horne (a friend of P. W. Fry) to Robert Hunt. An American, JAMES CUTTING, who had taken out a U.S. patent for ambrotype portraits, was granted an English patent in July 1854 for his particular method of sealing collodion positives to their covering glass by means of Canada balsam, to protect them from air, moisture, and dust. The name 'ambrotype' (Greek ἄμβροτος, imperishable) was suggested by Cutting's friend Marcus A. Root, a daguerreotypist in Philadelphia, and occurs for the first time in Britain in Cutting's patent. On the Continent such pictures were usually called amphitypes. Cutting's method of hermetically sealing the picture with Canada balsam was not novel, having long been in use for microscope slides. Nor was it necessary to protect the collodion image in this way, for–unlike the silvered surface of the daguerreotype –it is not acted on by air, and dust can be removed with a camelhair brush. In fact, we have never seen a British ambrotype sealed by Cutting's method.

Pls 97–100

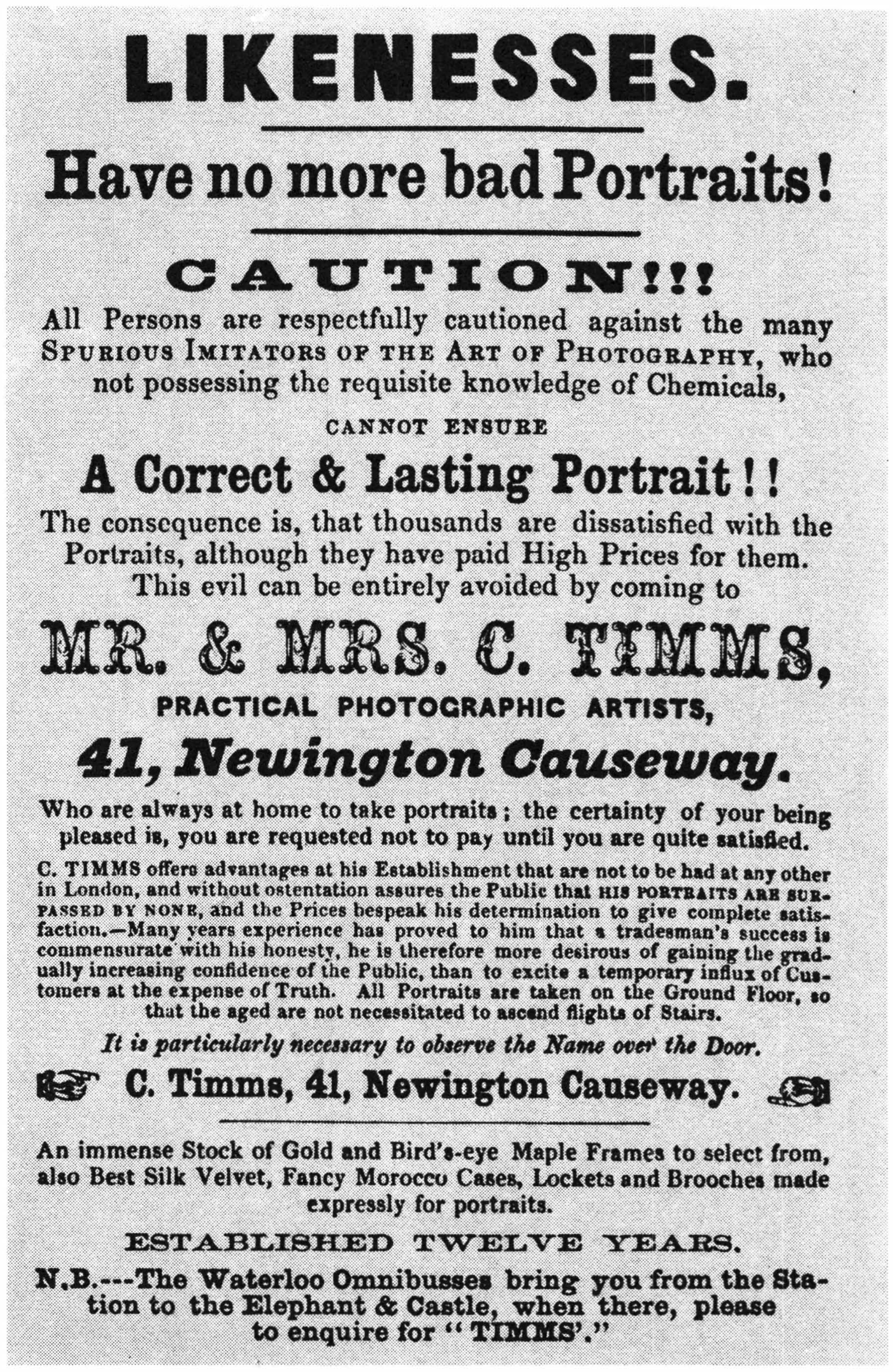
Ambrotypes were used almost exclusively for portraiture, and since the materials were cheaper and the manipulation simpler they soon displaced the daguerreotype altogether. They were exceedingly popular in England with the cheaper kind of photographer from 1852 until about 1863, when the fashion for cartes-de-visite superseded them.

The 'Relievo' ambrotype, introduced by Urie, a Glasgow photographer, in January 1854, took its name from the relief effect of the portrait. An ambrotype was made in the usual way, but only the figure and furniture were varnished black, and the whole background was carefully scraped away. Behind the picture was placed a comparatively thick piece of glass backed by white card. The photograph, being not quite in contact with the backing, cast a slight shadow on it, causing the figure to stand out in relief. It was doubtless due to the popularity of stereoscopic pictures that the idea of introducing relief by an 'air space' between picture and background (which had already been used for some silhouette pictures) was revived. In England, Thomas C. Lawrence, a Greenwich photographer, introduced 'Relievo' portraits in 1857.

Collodion positives on leather exist but are exceedingly rare. Probably the first to put forward the suggestion was G. R. Berry, a Liverpool photographer, in 1854.[5] Speaking of Talbot's claim to the collodion process on glass, he expressed the opinion that Japanned leather (patent leather) as used for fancy boots might be employed as a substitute for glass. In theory, collodion positives could be made on many black materials, but in practice, leather tended to crack, black paper proved too fragile, and the only satisfactory material, apart from glass, was black or chocolate-coloured enamelled sheet iron.

Melanographs. Collodion positives on black paper were introduced by Dr Giles Langdell of Philadelphia in 1853, and were called Melanographs (Greek μέλας, black) or Atrographs (Latin *ater*, black).[6] G. M. Campbell of Halifax, England, independently devised a method which he described in a letter to *The Photographic Journal*, July 1854.

Ferrotypes. ADOLPHE ALEXANDRE MARTIN, a French teacher and amateur photographer, is the originator of the ferrotype. In 1853 he presented a memoir to the Académie des Sciences describing the production of direct positives on tinned iron. In England a patent for ferrotypes was taken out in December 1856 by William Kloen of Birmingham and Daniel Jones of Liverpool. C. T. Masterman of London manufactured the enamelled iron plates in various sizes from $2\frac{1}{2}$ in. × 2 in. to 10 in. × 14 in. In the same year they were patented by Professor Hamilton Smith of Gambier, Ohio.



LIKENESSES.

Have no more bad Portraits!

CAUTION!!!

All Persons are respectfully cautioned against the many SPURIOUS IMITATORS OF THE ART OF PHOTOGRAPHY, who not possessing the requisite knowledge of Chemicals,

CANNOT ENSURE

A Correct & Lasting Portrait!!

The consequence is, that thousands are dissatisfied with the Portraits, although they have paid High Prices for them. This evil can be entirely avoided by coming to

MR. & MRS. C. TIMMS,

PRACTICAL PHOTOGRAPHIC ARTISTS,

41, Newington Causeway.

Who are always at home to take portraits; the certainty of your being pleased is, you are requested not to pay until you are quite satisfied.

C. TIMMS offers advantages at his Establishment that are not to be had at any other in London, and without ostentation assures the Public that HIS PORTRAITS ARE SURPASSED BY NONE, and the Prices bespeak his determination to give complete satisfaction.—Many years experience has proved to him that a tradesman's success is commensurate with his honesty, he is therefore more desirous of gaining the gradually increasing confidence of the Public, than to excite a temporary influx of Customers at the expense of Truth. All Portraits are taken on the Ground Floor, so that the aged are not necessitated to ascend flights of Stairs.

It is particularly necessary to observe the Name over the Door.

☞ **C. Timms, 41, Newington Causeway.** ☜

An immense Stock of Gold and Bird's-eye Maple Frames to select from, also Best Silk Velvet, Fancy Morocco Cases, Lockets and Brooches made expressly for portraits.

ESTABLISHED TWELVE YEARS.

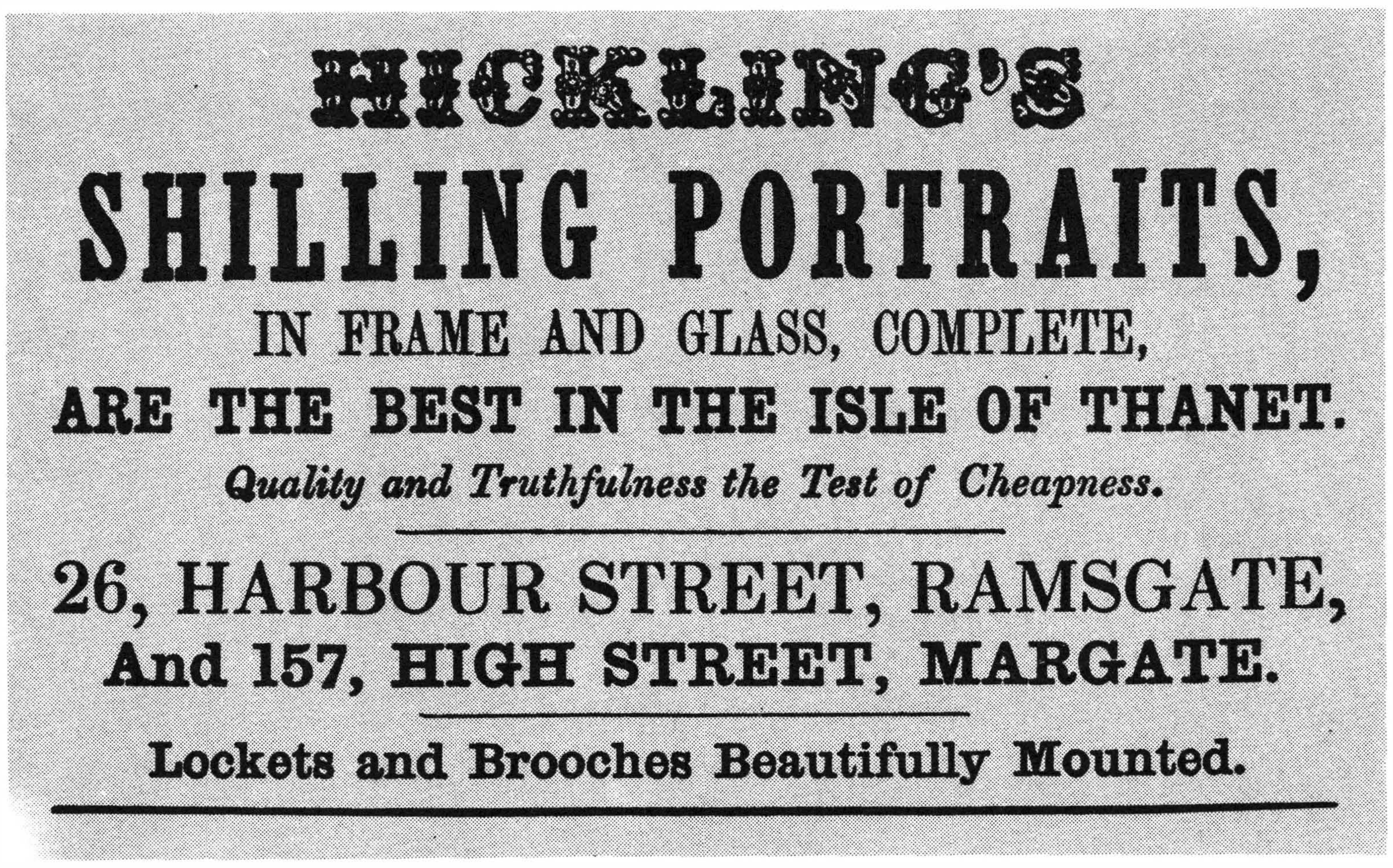
N.B.---The Waterloo Omnibusses bring you from the Station to the Elephant & Castle, when there, please to enquire for "TIMMS'."

Fig 27 Advertisement of Mr and Mrs Timms, c. 1857

The following year Peter Neff, a collaborator of Professor Smith, bought the patent rights and advertised these pictures as melainotypes, whilst the name ferrotype (Latin *ferrum*, iron) originated with the American manufacturer of the sheet iron, Victor M. Griswold. Ferrotypes became very popular in the United States with the cheaper photographers from *c.* 1860, and were collected in albums, or cut to any shape or size and fitted into brooches, lockets, shirt studs, etc.

In spite of the great stress which was laid on their strength compared with glass plates, these hideous, cheap-looking pictures failed to establish themselves in England, France, and other countries of the Continent until the late seventies, when they were introduced as 'an American novelty' by beach and street photographers. At country fairs and seaside resorts this kind of portrait could still occasionally be seen until the Second World War. It could be produced easily by itinerant photographers, and the finished product was handed to the sitter a few minutes after the exposure was made. Like ambrotypes on glass, ferrotypes or 'tintypes' were converted into direct positives. It is no doubt on account of their tinny appearance that in spite of their high-flown Greek and Latin names the public persisted in calling them tintypes.

None of the fashionable or good-class photographers took ambrotypes, which were looked down on as cheap stubstitutes for daguerreotypes. They were the speciality of the more modest establishments, and of the cheap traders who were attracted to photography by the quick profits to be made, becoming 'photographic artists' overnight without the faintest idea, even, of the manipulation, setting up their camera in the streets or converting their parlours or little courtyards into studios.
Fig 27 Ambrotypes were simple to make, no knowledge of positive printing being required.



HICKLING'S

SHILLING PORTRAITS,

IN FRAME AND GLASS, COMPLETE,

ARE THE BEST IN THE ISLE OF THANET.

Quality and Truthfulness the Test of Cheapness.

26, HARBOUR STREET, RAMSGATE,

And 157, HIGH STREET, MARGATE.

Lockets and Brooches Beautifully Mounted.

Fig 28 Advertisement of Hickling's shilling portraits, c. 1857

No longer was photography an art for the privileged: it had become the art for the million.

> Photographic portraiture is the best feature of the fine arts for the million that the ingenuity of man has yet devised. It has in this sense swept away many of the illiberal distinctions of rank and wealth, so that the poor man who possesses but a few shillings can command as perfect a lifelike portrait of his wife or child as Sir Thomas Lawrence painted for the most distinguished sovereigns of Europe.[7]

'Blessed be the inventor of photography', wrote Mrs Carlyle in 1859. 'I set him above even the inventor of chloroform! It has given more positive pleasure to poor suffering humanity than anything that has "cast up" in my time, or is like to–this art, by which even the poor can possess themselves of tolerable likenesses of their absent dear ones.' Fig 28

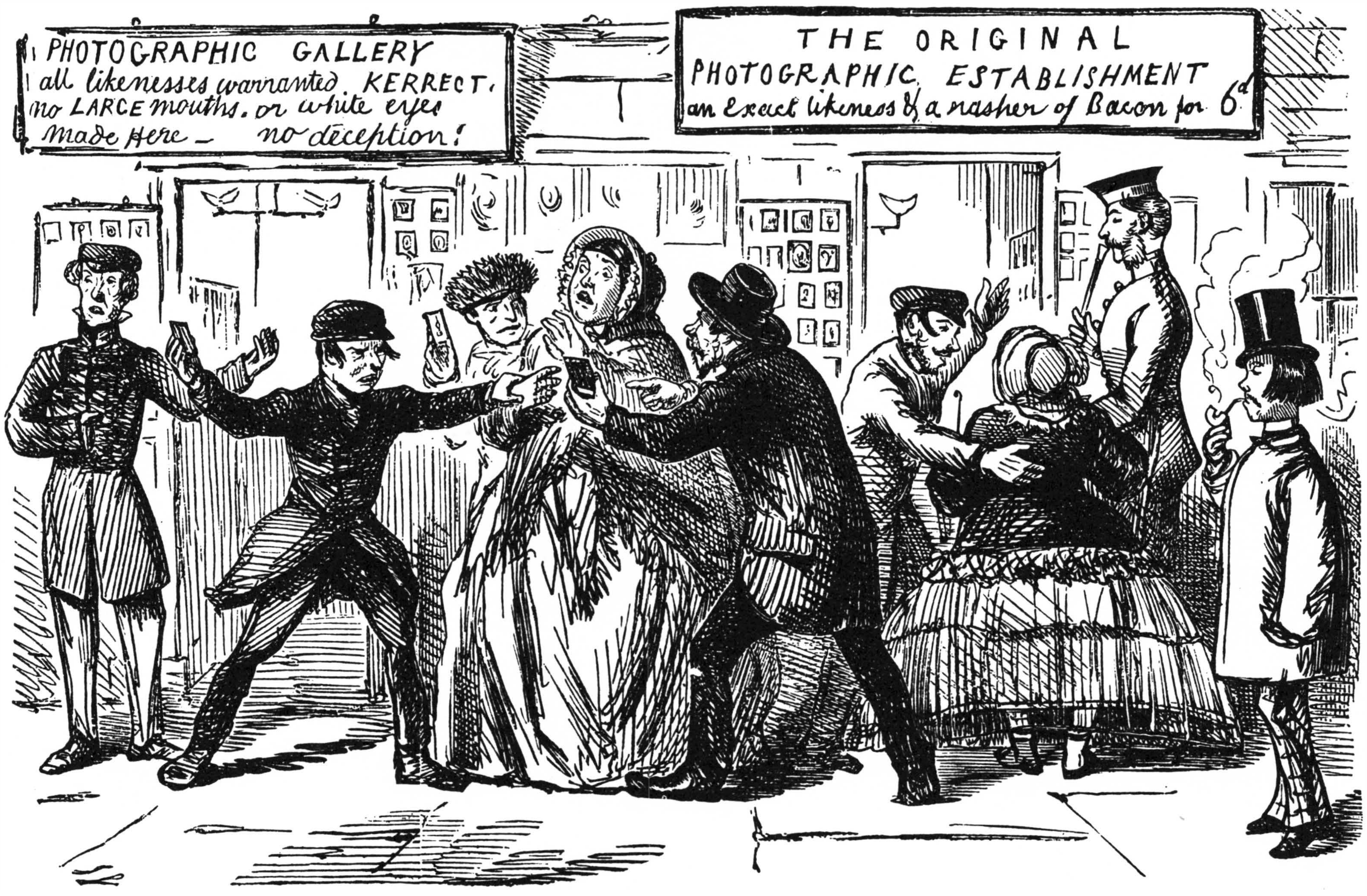
A visitor to Ramsgate claimed that, 'it appears to be as much the custom for the ladies who are staying here to have their portraits taken as to take a bathe; these establishments abound, and invitations to have one's portrait taken at 6*d*, with a discount of 18% on taking a dozen are numerous.'[8]

Henry Mayhew relates the story of such a cheapjack, who had been a travelling showman. This candid cameraman admitted without embarrassment:

> The very next day I had the camera, I had a customer, before I had even tried it, so I tried it on him, and I gave him a black picture (for I didn't know how to make a portrait) and told him that it would come out bright as it dried, and he went away quite delighted. I took the first Sunday after we had opened £1 5. 6., and everybody was quite pleased with their spotted and black pictures, for we still told them they would come out as they dried. But the next week they brought them back to be changed, and I could do them better, and they had middling pictures–for I picked it up very quick.

Often the picture did not come out at all, but the photographer and his partner were cunning enough to make the customer take it.

> Jim wraps it up in a large piece of paper, so that it will take some time to unroll it, at the same time crying out, 'Take 6d. from this lady, if you please.' Sometimes she says, 'Oh, let me see it first', but he always answers, 'Money first, if you please Ma'am; pay for it first, and then you can do what you like with it.' When she sees


PHOTOGRAPHIC GALLERY
all likenesses warranted. KERRECT. no LARGE mouths. or white eyes Made Here – no deception!
THE ORIGINAL PHOTOGRAPHIC ESTABLISHMENT
an Exact likeness & a rasher of Bacon for 6d

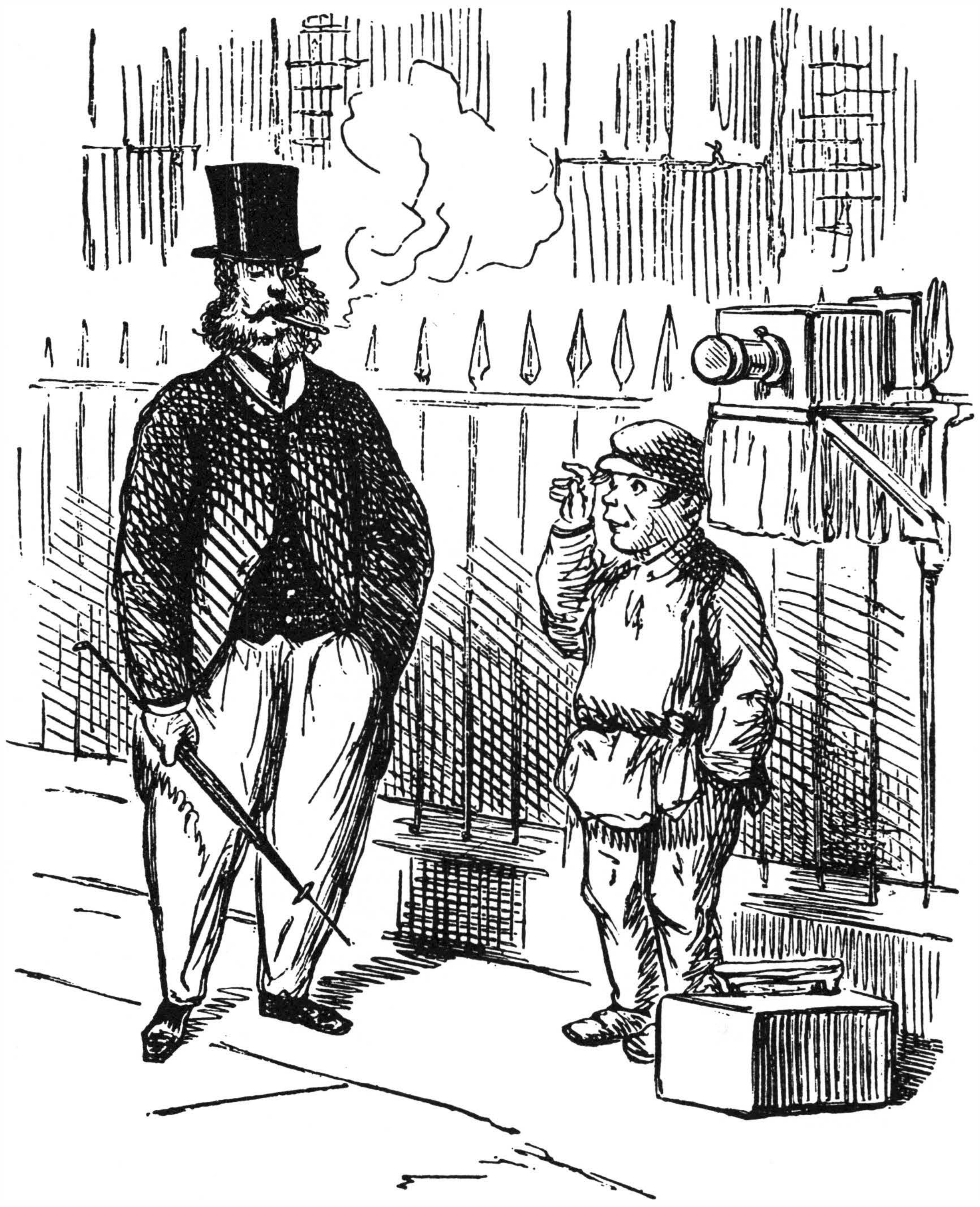
ART-PROGRESS.

Artist (!) "Now, Mum! Take orf yer 'ead for Sixpence, or yer 'ole body for a Shillin'!"

> it, if it is a black one, she'll say, 'Why, this ain't like me; there's no picture at all.' Then Jim says, 'It will become better as it dries, and come to your natural complexion.' If she still grumbles, he tells her that if she likes to have it passed through the brightening solution it will come out brighter in an hour or two. They in general have it brightened; and then before their face we dip it in some water. We then dry it off and replace it in the frame, wrap it up carefully, and tell them not to expose it to the air, but put it in their bosom, and in an hour or two it will be alright. This is only done when the portrait come out black, as it doesn't pay to take two for 6d. Sometimes they brings them back the next day and says, 'It's not dried out as you told us'; and then we take another portrait and charge them 3d. more.[9]

This was only one of many tricks played on customers. Sometimes when the weather was too bad, they went through the whole mumbo-jumbo of taking a photograph, but in fact wrapped up one of the specimen pictures they always had ready, and told the sitter not to open it for three days.

Soon these photographers became so numerous that great competition started between them. Touts stood at the doors of their 'establishments' with specimens in their grimy hands, wheedling the passers-by to come into the murky studios with offers of 'a cup of coffee and your portrait for sixpence'.[10] They had an impudent way of complimenting ladies on their good looks: 'Hallo, Ma'am, how beautiful you are looking today! On my word, as sure as I am looking at you, I never see'd you look handsomer! Now's the time to have your portrait taken! Lose the chance, Ma'am, and it may never occur again. Come along, my dear, and have your beauty immortalised for ever. It's only sixpence, Ma'am. Come along! Angels like you isn't caught every day.'[11] The delightful *Punch* cartoon entitled 'Art-Progress' is no exaggeration. These fellows were a thorn in the side of proper professionals. Fig 29



A HINT TO THE ENTERPRISING.

Boy. "HERE YOU ARE, SIR. BLACK YER BOOTS, AND TAKE YER LIKENESS FOR THE SMALL CHARGE OF THREEPENCE!"

Figs 29, 30 Cartoons from 'Punch', 1857

Many tradespeople took up photography as a profitable sideline and this led to the unhappy union of photography with ice-cream and roast-chestnut shops, with barbers and tobacconists, with Greenwich and Gravesend tea-and-shrimp rooms. 'The appetites as well as the vanity of the public are stimulated by the offer of "an eel-pie and your likeness for sixpence".'[12] Similar inducements were common in other trades. A tobacconist offered 'your likeness and a cigar for sixpence'; a barber gave men 'a shave and your shape' and ladies 'your likeness and a box of pomatum for sixpence'. A hatter had a glasshouse built adjoining his shop, and every purchaser of a hat had his portrait taken free of charge.[13] The position was similar in Paris, though cheap traders did not invade the boulevards until about 1859. We learn that on the Boulevard de Sebastopol, then just opened up by Haussmann, about thirty itinerant photographers could be counted, with signboards over their ramshackle huts inscribed 'Au Génie de la Photographie', 'Aux Merveilles du Nouvel Art', or 'Aux Fils de Daguerre'. Generally these low-class photographers made ambrotypes, or direct collodion positives on black waxed cloth, and the usual charge for these productions was 1 franc.[14] We hear of the extraordinary combination of a blacksmith-photographer.

> On one side of the yard was a smithy, with some bars of iron in the fire and a boy blowing a big bellows. On the other side was a kind of shed with a calico covering over one end. This was the 'glass room'. A piece boxed off at one end formed the darkroom. One franc [about 10*d.*] was the charge to be operated on, passepartout extra. The staff to manage both establishments consisted of the blacksmith and the boy already mentioned.[15]

In 1857 street photographers made their appearance in London. *Punch* illustrated one combining photography with the business of boot-black. Fig 30

The cost of the materials used in the collodion process varied considerably with different dealers. The following are average prices about 1855.

Best glass plates with ground edges:

	size in inches	*per dozen*
for ambrotypes	2 × 2½	1 0
	3 × 4	2 0
	5 × 4	3 6
for stereoscopic pictures	3⅜ × 7½	4 0
for large portraits, landscapes, architecture, etc.	6½ × 8½	9 6
	10 × 8	14 0
	12 × 10	£1 5 6
	15 × 12	£2 8 0

Morocco leather cases for ambrotypes, with velvet lining and gilt matt, cost from 15*s*. per dozen for plates 2½ in. × 2 in. to 60*s*. per dozen for plates 5 in. × 4 in.

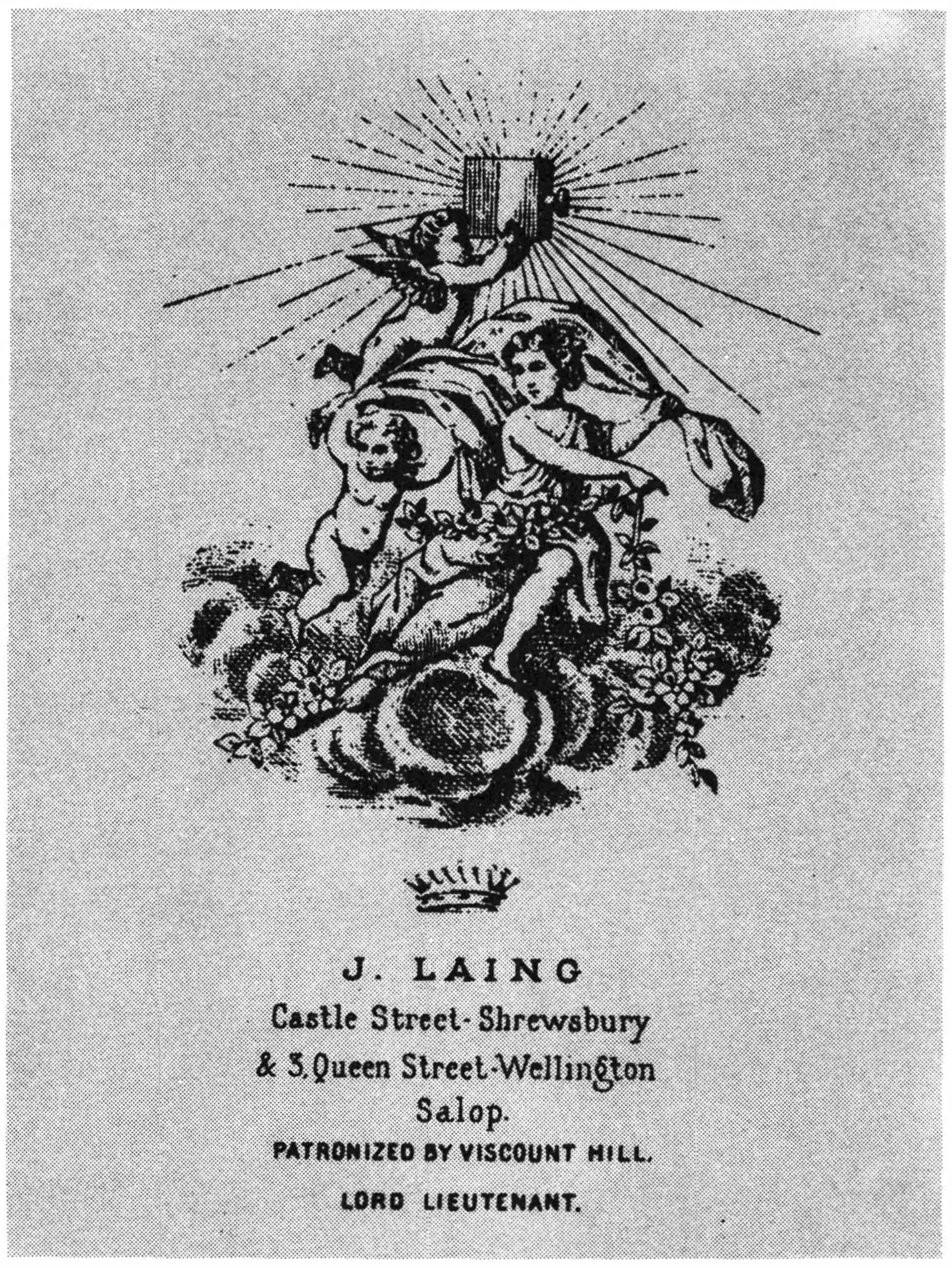
Iodized collodion	1*s* 0 – 1*s* 6	per oz (according to maker)
Nitrate of silver	4*s* 6	per oz
Pyrogallic acid	16*s* 0	per oz
Protosulphate of iron	1*s* 6	per lb
Hyposulphite of soda	1*s* 0	per lb
Potassium cyanide	6	per oz
Negative varnish	1*s* 0 – 1*s* 6	per oz (according to quality)
Albumen positive printing paper (9 × 11 inches)	5*s* 0 – 7*s* 0	per quire

19 *'High art' photography*

The part played by photography in contemporary life can best be gauged from the lengthy discussions and detailed exhibition reviews which then featured in newspapers and magazines as prominently as do film reviews today. Sometimes the friends of photography were carried away by their enthusiasm and expressed themselves in an incredibly pompous style: Fig 31

> Photography is an enormous stride forward in the region of art. The old world was well nigh exhausted with its wearisome mothers and children called Madonnas; its everlasting dead bodies called Entombments; its wearisome nudities called Nymphs and Venuses; its endless porters called Marses and Vulcans; its dead Christianity and its deader Paganism. Here was a world with the soil fainting and exhausted; worn by man into barrenness, over-crowded, over-housed, over-taxed, over-known. Then all at once breaks a small light in the far West, and a new world slowly widens to our sight–new sky, new earth, new flowers, a very heaven compared with the old earth. Here is room for man and beast for centuries to come, fresh pastures, virgin earth, untouched forests; here is land never trodden but by the angels on the day of Creation. This new land is photography, Art's youngest and fairest child; no rival of the old family, no struggler for worn-out birthrights, but heir to a new heaven and a new earth, found by itself, and to be left to its own children. For photography there are new secrets to conquer, new difficulties to overcome, new Madonnas to invent, new ideals to imagine. There will be perhaps photograph Raphaels, photograph Titians, founders of new empires, and not subverters of the old.[1]

Sometimes an attack on photography was equally ill-conceived. 'By invading the territories of art, this industry has become art's most mortal enemy. If photography is allowed to supplement art in some of its functions it will soon have supplanted or corrupted it altogether.' Baudelaire's bitter diatribe in his review of the Salon of 1859 has been taken as proof of his enmity towards photography. But this was not altogether the case. In the first place, Baudelaire admitted to Nadar that he had not visited the photographic section of the exhibition, and his article in the *Revue Française* was in the nature of a general essay against the growing commercialization of photography and its attendant vulgarization of taste as evidenced by the popular and frequently inane anecdotal and pornographic pictures for the stereoscope–none of which were shown at the Salon. Secondly, Baudelaire was no less disparaging about the banalities of the academic historical painters, and the trivialities–as *he* considered them–of the naturalist and realist painters. It was these that aroused his



J. LAING
Castle Street-Shrewsbury
& 3.Queen Street-Wellington
Salop.
PATRONIZED BY VISCOUNT HILL.
LORD LIEUTENANT.

Fig 31 Back of a carte-de-visite

ire, and he laid the blame for what he called 'the impoverishment of French artistic genius' at the door of commercial photography, 'the refuge of every would-be painter, every painter too ill-endowed or too lazy to complete his studies.'

Whether or not photography is an art was hotly debated in France and Britain. It is, however, a futile argument, for a large part of photography's output has no pretensions to art, and what small proportion has, must be judged like painting and sculpture on its merits and not in an abstract sense. In 1856 Nadar suggested that photography ought to be admitted to the exhibitions of the Académie des Beaux-Arts. This started an acrimonious paper-war between Henry Delaborde in the *Revue des Deux-Mondes* and the Abbé Moigno in the *Revue Photographique*, not dissimilar from the correspondence five years later between Claudet and Silvy in the *Photographic Journal* apropos of the proposed classification of photography under Machinery at the International Exhibition, London, 1862. In France a committee of seven was formed to investigate the question, including Delacroix and Théophile Gautier, both staunch supporters of photography. In consequence photography was admitted to the Salon of 1859–though by a separate entrance.

Misconceived notions of the proper functions of photography were brought to photography by third-rate artists, who abandoned their former profession in favour of the new art, which held out greater prospects for a rise to eminence, and proved more lucrative into the bargain. Some of the worst examples of 'High Art' photography were produced by artists who–failing to appreciate the function of photography, and also its limitations–attempted to 'raise' it from the reproduction of everyday things to the portrayal of 'loftier' subjects totally alien to the new medium. Attempts to illustrate scenes from literature, drama, and history, or allegorical subjects by a medium whose chief contribution to art lies in its realism must inevitably result in incongruous effects. It was a most unfortunate circumstance, both for art and for photography, that in the mid and late nineteenth century the public, artists, and art critics alike were inclined to judge painting by photography (in its capacity for rendering detail) and photography by painting (in the sphere of imaginative composition). Hence much of the good which each might have derived from the other was lost to both.

Courbet did not want to have anything to do with photography, yet the aesthetic ideal of the founder of Realism was 'the scrupulous imitation of nature'–at that time also the professed function of photography. Moreover, the tenet of the Realist manifesto (1856), 'One cannot paint what one does not see', was, with the substitution of one word, a photographic truism. Nevertheless, it was just to avoid this realism, 'too literal to compete with works of art', that some photographers, especially in Britain, went beyond the limitations of their medium. They were encouraged in this by most of the art critics and artists. The miniature painter SIR WILLIAM J. NEWTON, R.A., Vice-President of the Photographic Society of London, at its very first meeting stated that he was 'desirous of removing the false and limited view that a photograph should always remain as represented in the camera', and propounded the unorthodox opinion that an artistic photographer should improve his negatives 'in order to render them more like works of art' and further that any means was justified to attain that end.[2]

Many photographic exhibitions held all over the world today still provide ample evidence that the type of picture introduced in 1855 as a novelty by the watercolour painter WILLIAM LAKE PRICE is by no means dead yet. Having taken up photography in the previous year, Lake Price at once caught the public imagination with 'The Baron's Feast', 'Don Quixote in His Study' and other compositions conceived in the chivalric style of George Cattermole and other Royal Academicians of the period. Pl 102 Most people agreed that this was *picture-making* by photography, but few realized the literal truth of their verdict, for some of these elaborate compositions were actually pieced together from several negatives. Prince Albert at once extended his patronage to Lake Price, who followed up these successes with a series of photographs to illustrate the adventures of Robinson Crusoe. 'A Scene at the Tower' (1856) greatly impressed Lewis Carroll, who had just taken up photography as a hobby. He entered in his diary, 'This is a very beautiful historical picture–a capital idea for making up pictures.' Robert Hunt was alone among reviewers in doubting the desirability of attempting to rival the historical painter Paul Delaroche (the photograph represented the young princes who were murdered at the instigation of Richard III). 'We believe that such pictures as these will have a tendency to lower the appreciation of Art in the eyes of the public, and unfit them for receiving the full impression intended by, or for seeing the beauties of, the artist's production.'[2a]

Lake Price's lectures on art and photography, and articles on composition and *chiaroscuro* exerted considerable influence. His manual[3] filled a void in photographic literature–until then purely scientific and technical–being the first in which the student could obtain anything approaching an equal amount of instruction on the aesthetic side of his hobby or profession. He rightly emphasized that the cultivation of taste must go hand in hand with technical progress: 'If photography is to take a stand as an art, those who practise it must qualify to study for artistic requirements.' The misfortune was only that Lake Price, who between 1828 and 1852 regularly exhibited at the Royal Academy and the Water Colour Society, failed to realize that photography had to develop along different lines from graphic art. He was the first to succeed in reproducing Old Master paintings, for which he commanded very large fees from printsellers who issued his reproductions in the form of engravings. Colnaghi offered him 1,000 guineas for a negative of Raphael's 'Transfiguration' in the Vatican, but Cardinal Antonelli refused permission to photograph it on the ground of possible injury to the fresco![4]

OSCAR GUSTAVE REJLANDER was another artist-turned-photographer. A Swede by birth, he worked in Rome as a portrait painter and copyist of Old Masters. In the 1840s he set up as a portraitist in London, but during a visit to Rome in 1852 he admired some photographs of sculpture and thought of learning photography as an aid in painting. The formation of the Photographic Society of London the following year renewed his interest and he learned the rudiments of photography from Nikolaas Henneman–all in one afternoon, with the idea of making photographic studies of his sitters and of draperies as an aid to painting. Two years later he opened a photographic portrait studio in Wolverhampton, and in 1857 achieved a unique place in the history of photography with a large allegorical composition, entitled at Pl 104 first 'Hope in Repentance' and later 'The Two Ways of Life'. Thomas Couture's 'Les Romains de la Décadence' (1847) in the Louvre was probably the model, as it was later to be also for Anselm Feuerbach's 'Plato's Symposium' (1873) in Berlin. At any rate there is a close resemblance in erotic content and composition, the central columns dividing the picture into three distinct groups in which the figures, many of them semi-nude, are posed in *tableau-vivant* style. The Italian Renaissance was of course the source of inspiration for both painter and photographer. Couture was influenced by Veronese, Rejlander by Raphael. Raphael in 'The School of Athens' contrasted Philosophy and Science; Rejlander's 'Two Ways' are Industry and Dissipation. The question that engaged contemporary attention even more than the moralizing content of Rejlander's picture was how he obtained in that provincial industrial town so many female models willing to be photographed semi-nude and capable of holding such difficult poses. Years later Rejlander revealed that he employed Madame Wharton's 'Pose Plastique Troupe', who gave *tableau-vivant* representations of statues and groups from paintings.

Rejlander set out to rescue photography from the reproach, often made by its critics, that it was a mechanical art, and the Manchester Art Treasures Exhibition, 1857, was the immediate *raison d'être* for his composition. For the first time photographs were to be displayed alongside paintings, drawings, sculpture, and engravings, and Rejlander was fired with the ambition to create a picture worthy of the place accorded to photography. 'My ambition has been that this composition should be solely photographic', Rejlander later explained, 'and I think that as far as the conception of a picture, the composition thereof, with the various expressions and postures of the figures, the arrangement of draperies and costume, the distribution of light and shade, and the preserving it in one subordinate whole–that these various points, which are essential in the production of a perfect picture, require the same operations of mind, the same artistic treatment and careful manipulation, whether it be executed in crayon, paint, or by photographic agency.'[5] 'The Two Ways of Life' was dedicated to English artists not as a challenge but to show compositions from life, which at that time were novel. After making preliminary sketches, Rejlander printed his composition from thirty separate negatives of single figures and groups, and several more of the background, carefully masking all parts of the picture except what was being printed. Two sheets of paper had to be joined together, as none was made large enough for the complete picture, which measured 31 in. × 16 in.

Queen Victoria signified her approval of 'The Two Ways of Life' by buying it for Prince Albert, who greatly admired it and hung it in his study. The price of 10 guineas was very moderate considering that the production of the picture had taken six weeks, but Rejlander felt amply compensated by the honour bestowed upon him. He is known to have made three more copies, one of which was bought by Sir David Brewster when it was shown in London in 1858; and Rejlander's own copy was presented to the permanent collection of the Royal Photographic Society in 1925. The author found there a second version exhibiting many variations from the original composition.

For many years 'The Two Ways of Life' provoked heated discussions in photographic circles. Some called the picture 'the symbol of a new era in photography'; some doubted the suitability of combining a number of negatives in one composition; others questioned the propriety of treating such subjects photographically, or complained of the semi-nudity of some of the models. The Photographic Society of Scotland was so shocked that it refused to exhibit the picture, and this almost caused a disruption, for amateurs and professionals were divided into two distinct parties *pro* and *contra*. In the end a compromise was agreed upon: the 'respectable' part of the picture, Industry, was shown alone, a cloth being draped over Dissipation!

Rejlander followed up 'The Two Ways of Life' with a few other composite pictures, though nothing on so large a scale nor of so controversial a nature. 'Judith and Holofernes', 'The Head of St John the Baptist' (from two negatives), and 'Home, Sweet Home' (from eight negatives) are a few of the titles. Then in January 1859 he decided to abandon this kind of exhibition picture. 'I am tired of photography-for-the-public', he wrote to H. P. Robinson, a rising star in the field of picture-making by photography, 'particularly composite photos, for there can be no gain and there is no honour, only cavil and misrepresentation. The next exhibition must only contain ivy'd ruins and landscapes *for ever*–besides portraits.'

Rejlander's desire to advance the aesthetic side of photography was praiseworthy
but his attempt to rival painting was ill-conceived. Fortunately, lack of appreciation
for these elaborate compositions directed his interest into other channels. Many of
his delightful *genre* pictures are genuine slices of life revealing the depth of feeling and Pl 105
understanding of a fine artist, who had only followed the wrong path for a comparatively short period. He transferred his portrait studio to London in 1860, but making
studies for artists to work from–figure, drapery, close-ups of hands and feet–gave Pl 103
him the greatest satisfaction, even though the time they cost him, plus the model's
fee, was often more than he earned. Occasionally he would amuse himself by composing photographs after famous paintings, just as he had previously copied Old
Masters. His studies of little children attracted both Julia Margaret Cameron and
Lewis Carroll, to whom he gave advice, and some years later these pictures brought
him in contact with Charles Darwin, for whom he illustrated *The Expression of the* Pl 106
Emotions in Man and Animals (1872). He did not abandon painting, and exhibited at
the Royal Academy four portraits at various times between 1848 and 1873.

The third and most influential of the 'High Art' photographers was HENRY PEACH Pl 107
ROBINSON, originally an assistant in a bookshop and an amateur artist. Yet in spite of having a painting[5a] hung at the Royal Academy in 1852, Robinson made photography his career, opening a professional portrait studio at Leamington Spa five years later. Seeking an escape from the mass-production of portraits which he had to turn out for his daily bread, Robinson consoled himself by making pictures after his own heart in his spare time, and these he sent to exhibitions in the hope of defending the right of photography to be classed as art. He soon came under the influence of Rejlander, and eventually became 'the High-priest of photographic picture-making by rule and combination'. Like a few other intelligent photographers of the time, Robinson felt a revulsion against the overstressing of the importance of lenses, cameras, and processes. Preoccupation with technique had become a means in itself instead of a means to an end. 'We want to apply these discoveries to higher purposes than we have hitherto done.' With this we may agree, though not with Robinson's

dictum that 'The means of producing pictures in our art are as good as those of producing paintings in Raphael's time; and nothing but a deep and earnest study is required to make our pictures rank with the works of the most famous men.' The books which most influenced Robinson's artistic development were John Burnet's *Art Essays* and Ruskin's *Modern Painters.*

Artists looked on photography as merely a dull means of recording uninteresting facts, 'wilfully mistaking the instrument for the man, and always asserting that a photograph could have no influence on the feelings and on the emotions, that it had no soul'. Robinson sought to demonstrate the falsity of such views. His first composition Pl 108 'Fading Away' (1858), made up from several negatives, was 'calculated to excite painful emotions'–and Robinson fully succeeded in his intention. While Rejlander's 'Two Ways of Life' was objected to by some for 'appealing to the passions', 'Fading Away', which represented a 'dying' girl surrounded by her grieving mother, sister, and fiancé, was criticized for its 'morbid sentiment'. The controversy which the picture aroused had a flattering effect upon the fortunes of its author. Prince Albert, who had a large collection of photographs, gave Robinson a standing order for a copy of every pictorial photograph he produced.[6]

Thenceforward Robinson set himself the task of producing every year at least one such picture (sometimes as many as four) with the sole object of elevating the position of the art to which he was devoted. The result was unfortunate for photography, since Robinson's elaborate compositions were wholly artificial, and the praise and awards accorded to them by photographic juries, not only in England but also on the Continent and in America–which made Robinson the most bemedalled photographer in the world–led to a general emulation of this kind of picture-making, from which photographic exhibitions the world over have not yet recovered.

Pl 110 'The Lady of Shalott' (1861) was a bold attempt to illustrate Tennyson's romantic poem. This imaginative picture, made up from two negatives, is 'very Pre-Raphaelite, very weird, and very untrue to nature', and Robinson himself condemned it in later years: 'It was a ghastly mistake to attempt such a subject in our realistic art, and with the exception of an "Ophelia" done in a moment of aberration, I never afterwards went for themes beyond the limits of the life of our day.'[7] Yet while this deliberately artificial picture somehow succeeds in conveying something of the romantic spirit of Tennyson's poem, Robinson's favourite rustic compositions, which usually include professional models dressed up as village maidens in smocks and sunbonnets (because genuine country people were found to be too clumsy), strive after naturalism and fail completely.

The inspiration for 'Bringing Home the May' (1862) came from a poem by Spenser. It was Robinson's most ambitious effort, being printed from nine different negatives. Like a painter, Robinson built up his composition from numerous sketches, which were afterwards combined in a full-scale drawing. He then worked out what portions should go on each negative, and the best places for the joins. After that, he selected the models, costumes, and accessories. The weather in May 1862 was bad and for nine consecutive evenings a pony-cart laden with blossom was brought to the house, but to Robinson's dismay the next morning always turned out dull. At last on the tenth day some of the figures could be photographed and after an interval of several more dull days the remaining sections were completed.

In spite of the high price of 20 guineas which Robinson charged for the final exhibition print, measuring 40 in. × 15 in., the orders were so numerous that he decided to reproduce the picture and issue it half the size, charging only 1 guinea, rather than repeat the enormous labour of fitting the nine separate prints together, which each time entailed retouching the joins. Reviewers were completely taken in by the genuineness of this and other scenes of country life. 'Mr Robinson avoids all appearance of trick, and all theatrical effect, by never troubling the costumier, or "dressing" his figures. They are presented in the homely garb of actual life which seems to befit them as naturally as the leaves belong to the trees.'[8]

Robinson's technique in building up his compositions can be seen from the example illustrated in plate 109, a pencil sketch with one photographic figure set in. To facilitate the work on his pictures, Robinson arranged in the back garden, both of his studio in Leamington and later at Tunbridge Wells, a bank of earth covered with ferns, wild flowers, or brambles, according to requirements, with a rivulet of waste water from print washing. Sometimes the models were even photographed in the studio, behind a foreground of turf, ferns, etc., placed on a movable platform. The former arrangement is seen in another composition in which the joins between the separate figures and the landscape background were smoothed out in a grand retouching operation, after which the picture was rephotographed. Quite possibly this picture was a rejected composition, for the mound did not merge harmoniously with the landscape, and no amount of retouching would have made it do so. Other pictures achieve the author's intention. Yet is this photography? Decidedly not. It was scissor and paste-pot photomontage, and the final result could in many cases have been achieved in a less roundabout way. Some compositions would at the time have been technically impossible without photomontage. Without artificial light no one could have photographed a group against a window, as in 'Fading Away', so Robinson built it up from five separate negatives. As for the outdoor groups, the exposures necessary for such very large plates would have been too long for the many models involved to keep still. Enlarging from smaller negatives needed continuous sunshine, and was therefore not a practicable proposition. Robinson attempted the impossible, from the technical as well as from the artistic point of view. Twenty years later, when the technical difficulties had been overcome, he laid down the axiom that no photograph which could be obtained at one operation should be produced from several negatives, and that combination printing should be reserved for those effects that cannot be obtained on one plate.[9] However, he himself did not keep to the rule. 'Carolling' (1887)–two girls and a flock of sheep in a landscape– could undoubtedly have been taken at that time instantaneously, and the same could be said of 'When the Day's Work is Done' (1877) which was made from six negatives, and many others. Instead of *taking* pictures, picture-*making* by photography had become an obsession with Robinson. And Robinson's word became law, despite an occasional criticism such as that voiced by the editor of the *Photographic Art Journal* apropos of photography's claim for recognition as a fine art: 'These hopes of it must be based, not upon the cleverness of combination printers, but upon improvements in the art itself. We must develop pure photography.'[10]

A prolific and influential writer on pictorial photography, he contributed articles to practically every photographic journal in the English language. In addition he published between 1869 and 1896 a number of books which were translated into several languages. The best known, *Picture Making by Photography*, was reprinted as late as 1916–the best indication of Robinson's influence, not only in England, but wherever pictorialists were at work.

ROGER FENTON, a pupil of Paul Delaroche, who had also been an exhibitor at the Royal Academy in 1849–51, urged the members of the Photographic Society not to make up scenery artificially but to photograph direct from nature; yet even he occasionally succumbed to the pictorial heresy. His coy English models dressed up as 'Nubian water carriers' or 'Egyptian dancing girls' were certainly photographed from nature in a straightforward manner, yet they were none the less artificial. But such pictures aroused the enthusiasm of contemporaries.

Pl 112 Among Fenton's successful pictorial compositions are a number of still-lifes–a field which has often attracted pictorial photographers. Apart from ADOLPHE BRAUN
Pl 111 and LAKE PRICE none was so successful as Fenton in composition or in rendering texture with a delicacy rivalling Dutch still-lifes. Critics accused Fenton of plagiarizing the contemporary painter George Lance, but it is more probable that Lance used Fenton's photographs as studies for his paintings.

If a great many of the figure studies by JULIA MARGARET CAMERON strike us nowadays as affected or sentimental, it is because she, like the previously mentioned photographers, could not help being influenced in matters of taste by the *Zeitgeist*. Their photographs are by no means isolated instances of bad taste. The same kinds of subject enjoyed great popularity in all the arts at the time, and often earned large sums. Many of Mrs Cameron's anecdotal subjects, such as 'Pray God, bring father safely home', 'Seventy years ago, my darling, seventy years ago', are examples of the worst kind of Victorian sentimentality. How refreshing, in contrast, are the photographs of the only other well-known woman photographer of the time–LADY HAWARDEN.
Pl 113 Her study 'The Toilet' is among the most delightful pictures of the period.

Mrs Cameron is rightly regarded today as one of the greatest portraitists in the comparatively short history of photography, though her fine portraits of famous men form only a small part of her total output during the fifteen years she devoted to photography. To most contemporary photographers her unretouched close-ups of the great Victorians seemed strange, too truthful, even ugly. On the other hand, her religious and allegorical compositions after Old Master paintings (e.g. her many Madonna studies, 'The Five Foolish Virgins', 'St Cecilia', 'Charity') reminded art critics of 'Caravaggio, Tintoretto, Giorgione, Velasquez, and other princes of their art. The aggroupments and figures are so skilfully arranged that it is difficult to determine what they could gain by being painted.'[11] Another art critic called Mrs Cameron's allegorical compositions 'Faith', 'Hope' and 'Charity', 'The closest approach to art, or rather the most bold and successful application of the principles of fine art to photography.'[12] No other nineteenth-century photographer won such general acclamation from art critics and leading artists as Julia Margaret Cameron. George Frederick Watts, considered by his contemporaries as a nineteenth-century Titian (whom, incidentally, he strongly resembled in appearance), believed 'her work will satisfy posterity that there lived in 1866 an artist as great as Venice knew',[13] and beneath one of Mrs Cameron's photographs of Florence Fisher he wrote, 'I wish I could paint such a picture as this.'

G. F. Watts was Mrs Cameron's chief artistic adviser, and Tennyson's romantic anecdotal poetry, beloved of the Pre-Raphaelites and often the subject of their illustrations, was the main source of her inspiration. Both were close friends of Mrs Cameron, and for many years her neighbours at Freshwater, Isle of Wight. Tennyson was to most Victorians 'the well-head of an enchanting river of song', and by none was he more esteemed than by Mrs Cameron. His verses touched her heart and quotations from his poems constantly flowed in her mind. Whenever she met someone who seemed to her a personification of one of his characters, she would not rest until she had persuaded him or her to sit for her. Sometimes this led to embarrassing moments, as when she met Bishop (later Cardinal) Vaughan, who seemed to her an ideal knightly figure. 'Alfred, I have found Sir Lancelot!' she called out to Tennyson, but the poet's bad sight prevented him from seeing whom she was pointing out, and he replied in his deep, penetrating voice, which attracted the attention of all the guests present, 'I want a face well worn with evil passion.'

The Pre-Raphaelites dedicated some of their best work to Tennyson: Mrs Cameron some of her worst. Yet Tennyson, who was completely indifferent to the visual arts, grumbled at certain of the Pre-Raphaelite illustrations, but accepted all of Mrs Cameron's with equal praise. Many of Tennyson's verses inspired Mrs Cameron's photographs, but only a few titles can be mentioned, the majority of which have only the quotation in common with Tennyson's original–they are in every other respect her own idealized representations. 'Enoch Arden', 'The Princess', 'The Dedication', 'St Agnes', 'Oenone', 'Maud', 'The Rosebud Garden of Girls', 'The May Queen'. Tennyson's verses sometimes sound banal to mid-twentieth-century ears, and Mrs Cameron's photographs often appear mawkish, even ludicrous. Indeed, some of her twenty-four illustrations to *The Idylls of the King, and Other Poems*, taken at Tennyson's own request in 1874, are reminiscent of the worst kind of amateur theatricals. In spite of the singular industry with which Mrs Cameron arranged her figures to bring the characters into the region of pure ideality, her compositions produce a realistic instead of a poetic effect. She chose subject matter impossible for photography. What Mrs Cameron had in common with the Pre-Raphaelites was that neither realized the limitations of their medium. The Pre-Raphaelites failed because they became 'photographers' in painting; Mrs Cameron, H. P. Robinson, Lake Price, and a host of other Victorian photographers failed because they approached photography with a painter's outlook.

CLICHÉ-VERRE

Painting and photography are totally different media. The only legitimate combination of the two is the process of *cliché-verre*, in which pictures drawn or painted on glass are copied on to photographic paper. It is a simple, accurate, and cheap method of multiplying in monochrome designs painted with semi-transparent varnish or oil paint on a glass plate, or scratched with an etching needle on an opaque coating such as sensitized collodion darkened by exposure to light.

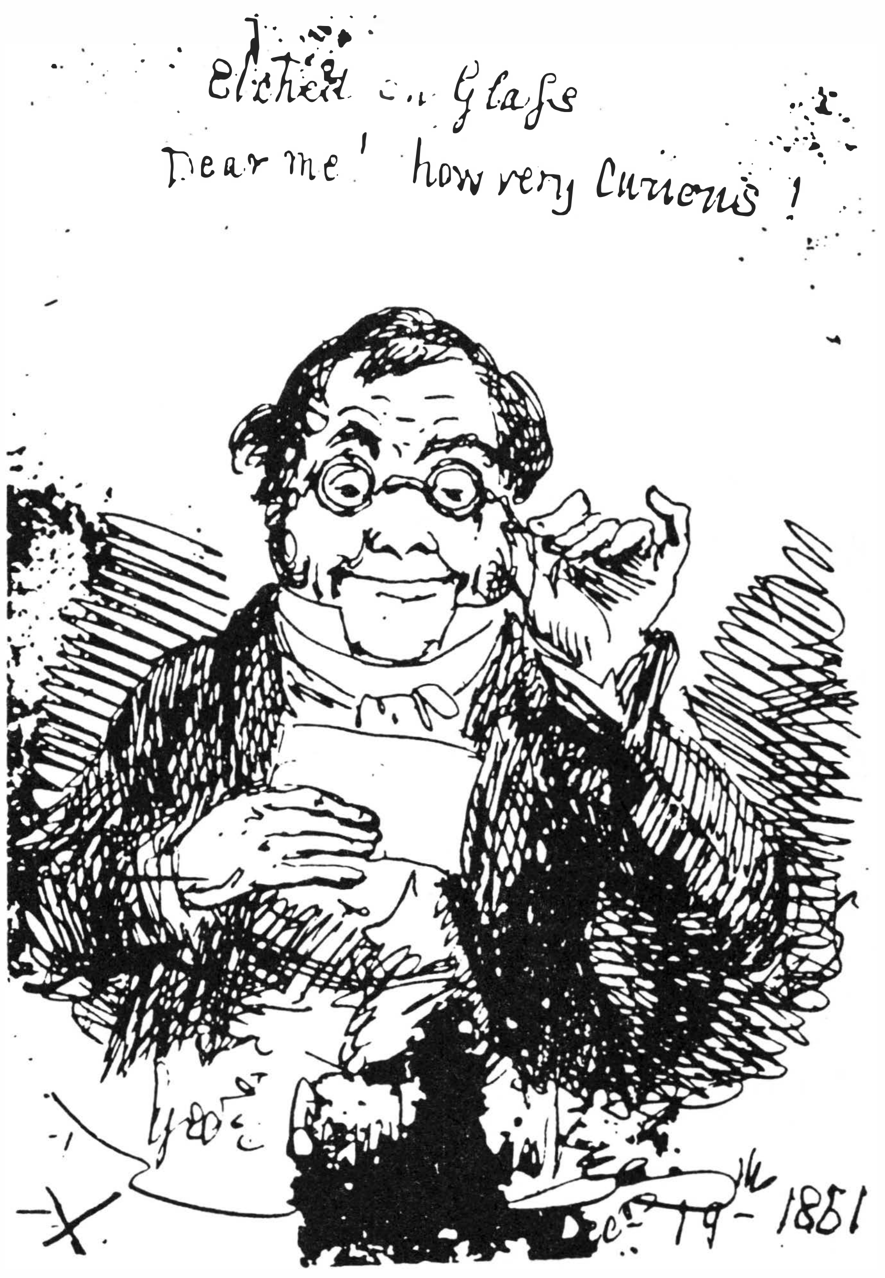


Fig 32 George Cruikshank. Caricature of Peter W. Fry, December 1851

The process was devised, soon after the announcement of Photogenic Drawing, by three artists and engravers–WILLIAM and JOHN F. HAVELL and J. T. WILMORE–who exhibited photogenic prints from their designs at the Royal Institution on 22 March 1839 and at the Royal Society's conversazione the following evening. A description of two methods, for etched and painted effects, was given by William Havell in *The Athenaeum* and *The Literary Gazette* on 30 March. When Fox Talbot learned of their intention to patent the process (of which he had read the previous week) he came forward with the claim that nearly five years earlier he had made imitation etchings executed with a needle upon glass covered with dark varnish.[14] He also claimed priority in publication, referring to point 7 of his memoir to the Royal Society of 31 January 1839; but in this passage Talbot only described a method of copying paintings-on-glass as previously attempted by Wedgwood. The Havells's and Wilmore's intention was the opposite of Talbot's, who employed Photogenic Drawing 'to delineate natural objects without the aid of the artist's pencil'; *their* aim was 'to delineate the work of the artist's pencil by Photogenic Drawing'.[15]

No copies of these early *clichés-verre* seem to have survived, and the earliest known Fig 32 to us is the caricature of the photographer P. W. Fry by GEORGE CRUIKSHANK, 1851. Two years later three French amateur photographers–the lithographer-painter CONSTANT DUTILLEUX, L. GRANDGUILLAUME, Professor of Drawing, and ADALBERT CUVELIER, an industrialist of Arras–jointly 're-invented' the process, using (like Cruikshank) the recently discovered collodion as the coating. In May 1853, COROT, a friend of Dutilleux, came to stay at Arras, and becoming enthusiastic for *clichés-verre*, made his first design in this medium. During the next seven years, in particular, Pl 114 Corot often worked in this technique, and shortly before his death in 1875 made his sixty-sixth and last *cliché-verre*. Other mid-nineteenth-century French artists–chiefly painters of the Barbizon School–who worked in this medium include Daubigny, Millet, Théodore Rousseau, and Paul Huet. They came to it largely at the instigation of Cuvelier, who saved them trouble by preparing the plates and making the prints. Collodion was later abandoned, because it had a tendency to flake off when scratched, in favour of a coating of printer's ink on which finely powdered white lead was spread. Sometimes Corot and Daubigny painted in oils on the glass instead of scratching on a ground, and printed in the same way, occasionally interposing a plain glass plate to soften the effect.

Cuvelier carefully preserved the plates, and before they were dispersed by his son to various museums (the Louvre, the Bibliothèque Nationale, and the Museums of Boston and Detroit), 150 prints were pulled from 40 of the best plates and published in 1921.[16] Among them are the only *cliché-verre* made by Delacroix, and the only two made by Millet and Rousseau.

Apparently unacquainted with the previous work in this field, an English artist, ROBINSON ELLIOTT, in September 1857 patented the painting-on technique, and JOHN W. EHNINGER published in New York in 1859 'Twelve Autograph Etchings' by himself and other American artists, to which the publishers appended a full description of this new application of photography–as they believed it to be.

Since then the *cliché-verre* process has been repeatedly brought up[17] but has never been able to establish itself in spite of these group efforts.[18]

20 *Stereoscopic photography*

The phenomenon of binocular vision – which forms the basis of stereoscopic photography and of three-dimensional films – consists in the mental fusion of the slightly dissimilar images seen by our two eyes separately into one image giving the effect of solidity.

The difference of the two images was observed by Euclid[1] about 280 B.C., by Galen[2] (A.D. 130–200), physician to Marcus Aurelius, by Leonardo da Vinci,[3] by della Porta,[4] by the Jesuit François d'Aguillon[5] in 1613, by the Capuchin monk Chérubin d'Orléans[6] in 1677, and many others. Indeed, it must be evident to anyone who looks at a near object first with one eye and then with the other. But it was not until 1832 that SIR CHARLES WHEATSTONE, F.R.S., realized that the appearance of Pl 115 solidity and distance which we see naturally with our two eyes, could also be produced artificially by making two drawings from slightly different viewpoints and presenting each to the appropriate eye only in an instrument of his own invention which he called the stereoscope. Thus Wheatstone became the founder of stereoscopy as a science. In the latter part of 1832 he had stereoscopes of two types (one with reflecting mirrors, the other with refracting prisms) made for him by the London opticians Murray & Heath.[7] A brief notice of his observations appeared in the third edition of Professor Herbert Mayo's *Outlines of Human Physiology*, 1833. But as Wheatstone was occupied for the next five years with the electric telegraph, he laid aside the preparation of his paper on the stereoscope. In his communication to the Royal Society[8] in 1838 he briefly mentions several forms of stereoscopic instruments, and describes in detail the reflecting stereoscope 'by means of which two perspective diagrams of the same object were seen at one view as completely solid as the object itself'. Sir John Herschel characterized the discovery as 'one of the most curious and beautiful for its simplicity in the entire range of experimental optics'.

Wheatstone suggested the name stereoscope (from the Greek στερεός, solid, and σκοπέω, I look at) 'to indicate its property of representing solid figures', but he did not coin the word as is sometimes mistakenly supposed, for *stéréoscopique* occurs in the *Traité d'optique* of the Belgian Jesuit François d'Aguillon published in Antwerp in 1613, and the French optician J. G. A. Chevallier used the term *stéréoscope* in his book *Le Conservateur de la Vue* (third edition, Paris, 1815) to denote a form of magic lantern projecting opaque pictures instead of transparencies – an instrument which we nowadays call epidiascope.

In Wheatstone's *reflecting stereoscope* two pictures were fixed vertically at each end Fig 33 of a horizontal bar, facing a pair of mirrors midway between them, and at right-angles to each other. The picture size could vary from about 2 in. to 8 in. high and

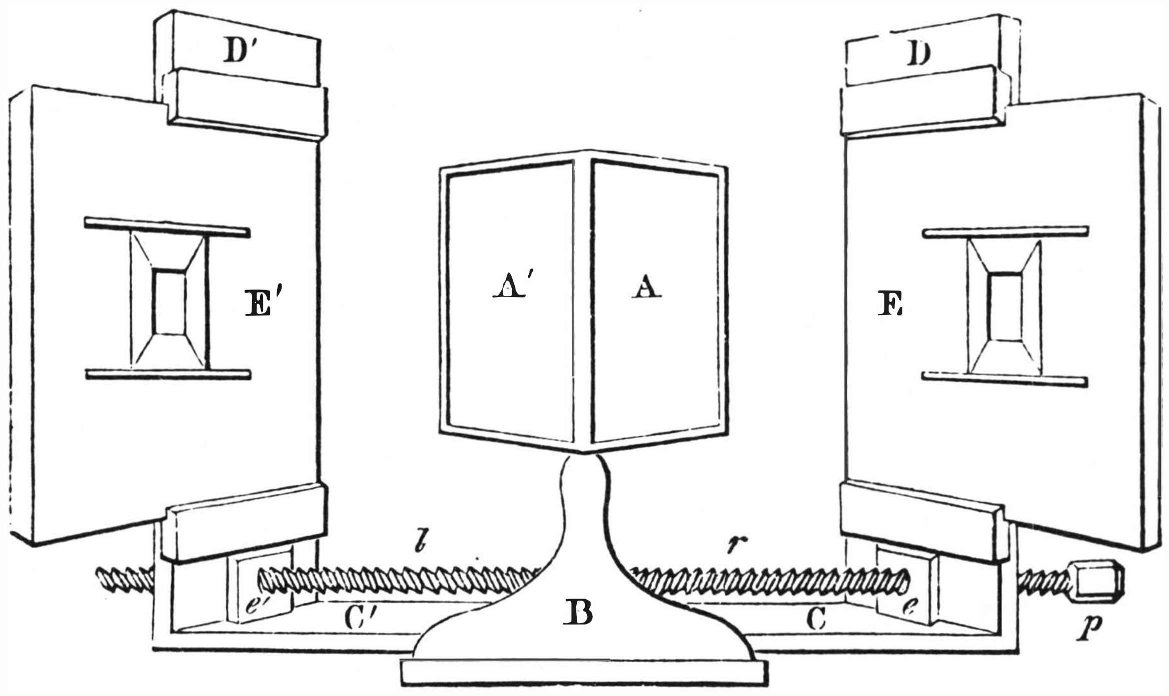


Fig 33 Wheatstone's reflecting stereoscope, 1838

was usually of large size. The observer was enabled to see the reflected pictures simultaneously, each eye seeing only one image. The instrument served admirably to show drawings of simple geometric figures such as cubes and pyramids as solid bodies, but it proved almost impossible to make pairs of binocular drawings of portraits, landscapes, or architecture, and but for the advent of photography the stereoscope would probably have remained a valuable scientific instrument for studying the physiology of vision, but of no popular interest for viewing pictures.

Soon after the publication of Talbot's and Daguerre's inventions, Wheatstone requested the leading portrait photographers to make pictures for his instrument. He first approached Richard Beard and then the calotypist Henry Collen who, under his direction, took in August 1841 a pair of stereoscopic portraits of Charles Babbage. 'Successful as the portraits were then considered', wrote Collen, 'I did not pursue the subject on account of the comparatively long time at that period required for the consecutive sittings for two pictures without movement on the part of the sitter.'[9] In the following year Wheatstone asked A. Claudet, and H. Fizeau in Paris, to make some pictures, but daguerreotypes proved unsuitable for examination in his stereoscope which admitted light from all directions on account of reflections from the metallic surface. For the same reason Professor Moser's independent attempts in Königsberg (October 1841) also remained abortive. Nevertheless Southworth and Hawes of Boston, Mass., took a large number of views which are preserved at George Eastman House.

On the other hand, calotypes of inanimate objects were very successfully viewed in Wheatstone's instrument, and splendid large pictures were taken for the purpose by Fox Talbot (1841), Dr Percy, B. B. Turner, Alfred Rosling, and Roger Fenton,[10] and such pictures were on sale in 1846 at the shop of James Newman, Soho Square.[11] Nevertheless, stereoscopic photography did not arouse public interest until Sir David Brewster's lenticular stereoscope had established itself, for the difficulty and cost of producing two large photographs for Wheatstone's reflecting stereoscope kept their price high.

Pl 117 In March 1849 Sir David Brewster, F.R.S., described his refracting or *lenticular stereoscope* to the Royal Society of Edinburgh. It was a modification of the second type of stereoscope suggested by Wheatstone in 1838, in the form of a small box in which two small pictures mounted side by side were viewed through a pair of semi-lenses or prisms which magnified the image. The width of each half of the binocular picture was limited to $2\frac{1}{2}$ in. (sometimes 3 in.) because the centres of the two pictures ought to be the same distance apart as the average distance between the pupils of the eyes; the height was limited by the dimensions of the box to 3 in. Brewster exhibited the first model, made by Andrew Ross, at the British Association Meeting that year, and put forward the suggestion of applying photography to it, without which his instrument would have been of no practical value. However, his suggestion made little impression at first and he endeavoured vainly to induce several English opticians to take up its manufacture. After trying for more than a year to overcome their apathy, he eventually took his instrument to Paris in 1850, where the Abbé Moigno, author of the compendious *Répertoire d'optique moderne*, was greatly impressed by the wonderful effect of relief and was able to interest the optician JULES DUBOSCQ, who at once realized its great future. For viewing opaque prints, light was admitted by opening a lid at the top of the box. Later on the instrument was adapted for viewing transparent pictures on glass or translucent paper by replacing the solid bottom of the stereoscope with a ground-glass screen. Pl 118

At the Great Exhibition a number of stereoscopes of Duboscq's construction were shown in conjunction with a beautiful set of stereoscopic daguerreotypes which aroused Queen Victoria's admiration, and Duboscq made a specially elaborate stereoscope for her. As a result of the Queen's interest he was flooded with orders. English opticians also began to manufacture stereoscopes, and nearly a quarter of a million instruments were sold in London and Paris within three months. Subsequently Duboscq patented the stereoscope on 16 February 1852, and seized the instruments and pictures of his Parisian competitors such as Gaudin, Soulier, and others. In the ensuing lawsuit they were able to prove that Brewster himself had suggested all forms of the instrument, and the patent was declared void on 10 December 1857.

The leading daguerreotypists in London–Claudet, Beard, Mayall, Kilburn, and Williams–immediately turned their attention to taking stereoscopic views of the interior of the Crystal Palace and of the exhibits. Claudet succeeded also in taking portraits and even groups, 'in one, as many as six full-length figures, the distinctness and roundness of which is so lifelike as to be almost startling; and so instantaneous is the process by which the pictures are taken, that even a number of children, difficult as it is to get them to sit steady, may be taken at once'.[12] The group to which the writer in *The Illustrated London News* referred is the charming 'Geography Lesson' which came into the possession of the Gernsheim Collection with a large number of stereoscopic daguerreotypes of the Great Exhibition by Claudet. Claudet took these pictures with two cameras set up side by side–a binocular camera had not yet been constructed–and the resulting pictures give a somewhat exaggerated rotundity and an effect of small models because the lenses were farther apart than the distance between the eyes. A selection of these photographs was sent to the Tsar of Russia, who, unable to visit London, was so delighted to be able to form a correct impression of the Exhibition that he presented Claudet with a diamond ring accompanied by a letter complimenting him on the effect of relief obtained in the stereoscope. Claudet proudly made a stereoscopic daguerreotype of the ring,[13] an engraving of which was published in *The Illustrated London News* in April 1852. Pl 116

Claudet devoted himself ardently to the improvement and development of stereoscopic photography, striving ceaselessly to advance it, and he was largely instrumental in securing its popularity. In January 1853 he gave a lecture on 'The History of the Stereoscope and its Photographic Applications' at the Society of Arts, and for his promotion of this branch of photography he received the Society's medal from its President, Prince Albert. In March of the same year Claudet patented a folding pocket stereoscope in which one stereoscopic daguerreotype–usually the portrait of its owner or his family–was fitted in a little morocco leather case with a flap containing two lenses. When opened it formed a box stereoscope. Pl 119

A defect of the Brewster/Duboscq design was that the eyepieces were not adaptable to various sights nor fitted with adjustments to suit people whose eyes were not the normal distance apart. This defect was overcome in Claudet's improved instrument, patented in March 1855, in which the lenses were set in adjustable tubes. The same patent also protected his invention of the large revolving stereoscope in which up to 100 stereoscopic slides were mounted on an endless band and rotated by knobs.

Duboscq, Claudet, and others worked for many years on the possibility of combining the stereoscope with the zoetrope, and their experiments with 'moving photographic figures', as Claudet termed them, marked the first step towards three-dimensional motion pictures. In his patent of February 1860 P. H. DESVIGNES suggested showing for this purpose a series of stereoscopic views in a revolving cylinder, and cited as an example photographs of a steam engine 'in which each view must be taken when the engine is at a different part of its stroke'. Several pairs of stereoscopic pictures of posed consecutive phases of an action such as a man taking his hat off were mounted in a revolving cylinder with as many slots as there were views, and thus the illusion of relief and motion were combined in the pictures. Such instruments, called 'stereotropes', were shown at the International Exhibition, 1862.

Claudet's stereomonoscope, described to the Royal Society in April 1858,[14] was an improved viewing instrument in which the two stereo-pictures were combined into a single image on a large ground-glass screen, enabling several spectators to see the picture at the same time.

The sudden popularity of the lenticular stereoscope, which almost superseded the reflecting stereoscope,[15] seems to have gone to Brewster's head, and his personal antagonism to Professor Wheatstone led him to make certain incorrect statements in an attempt to deny him the credit of being the first to obtain stereoscopic effect from flat pictures. In his book *The Stereoscope* (1856) Brewster stated that James Elliot of Edinburgh had preceded Wheatstone 'in the general conception of a stereoscope', although Elliot himself had renounced all claim to priority–which was based on a mistake–four years previously.[16] Brewster was extremely tenacious of an opinion once he had formed it, and revived the controversy in a most extraordinary manner in an anonymous letter to *The Times* in October 1856, in which he not only disputed Wheatstone's claim to the invention of the stereoscope, but even denied his priority in the discovery of the principle upon which it is founded. In the ensuing polemical correspondence between himself (no longer anonymous) and Wheatstone in October and November, Brewster showed extreme spite. He thoroughly enjoyed public duelling, not only with Wheatstone but also with other scientists. Though his misrepresentations of fact were completely refuted by Wheatstone, Brewster took the opportunity to renew his attack on the occasion of the discovery at a Lille museum in 1859 of two almost identical drawings by the seventeenth-century Florentine artist Jacopo Chimenti. These he acclaimed as stereoscopic drawings made over two centuries before Wheatstone–an assertion refuted by scientists in England and France: only the members of the Photographic Society of Scotland politely agreed with their disputatious President. It is therefore the more astonishing that Professor Stenger, writing about early stereoscopy,[17] should give credit to these Chimenti drawings, although they are drawn in such a way that any relief they present is the result of slight unintentional variations between the original and the copy made from it.

When the collodion process had established itself, stereoscopic photography, like photography in general, received a tremendous impetus, for paper positives mounted on cardboard could be mass-produced and sold at a fraction of the price of stereoscopic daguerreotypes.

In 1854 a man of humble origin, GEORGE SWAN NOTTAGE, founded the London Stereoscopic Company for the manufacture and sale of lenticular stereoscopes and the production of binocular pictures. Within two years the stereoscope was in use in all parts of the world, and it was estimated that this firm alone, which then offered a choice of over 10,000 stereoscopic slides, had already sold half a million instruments. They produced 'a stereoscope for the million' at a price of only *2s. 6d.* The price of the pictures varied from *1s.* to *1s. 6d.* according to subject.

By 1858 the London Stereoscopic Company advertised a stock of 100,000 different photographs of famous buildings and places of interest in England and abroad, and sent their staff photographers as far afield as the Middle East and America. **WILLIAM ENGLAND**, who was with the firm from its inception, helped to build up its reputation with the thousands of stereoscopic pictures which he took on his journeys in Ireland (1858), America (1859), Paris (1861), and elsewhere. His series 'America in the Stereoscope', in particular, excited much interest, being the first views of American scenery and architecture to come across the Atlantic. Among the many scenes depicted, the view of a train crossing the Niagara Falls and the picture of Blondin on a tightrope over the Falls aroused astonishment. Pl 123

Thus the stereoscope not only went to all corners of the world it also brought the corners of the world to the Victorian fireside. It was, as Claudet wrote, Pl 120

> The general panorama of the world. It introduces to us scenes known only from the imperfect relations of travellers, it leads us before the ruins of antique architecture, illustrating the historical records of former and lost civilizations; the genius, taste and power of past ages, with which we have become as familiarized as if we had visited them. By our fireside we have the advantage of examining them, without being exposed to the fatigue, privation, and risks of the daring and enterprising artists who, for our gratification and instruction, have traversed lands and seas, crossed rivers and valleys, ascended rocks and mountains with their heavy and cumbrous photographic baggage.[18]

Like the kaleidoscope, Brewster's beautiful toy invented 35 years earlier, the stereoscope had conquered the world. Men, women, and children, rich and poor, now gazed into this 'optical wonder of the age', just as the preceding generation had gazed into the wonder-working tube, admiring the beautiful patterns it produced and the magical changes which the least movement of the instrument occasioned. The stereoscope seemed to have become an inexhaustible source of enjoyment, finding a place in every drawing-room, for it provided 'refined amusement combined with useful instruction'–the criterion of Victorian recreation. '*No home without a stereoscope*' was the claim of the London Stereoscopic Company, and George Swan Nottage amassed a great fortune, and was elected Alderman and later Lord Mayor of London.

In stressing the advantages of his instrument for educational purposes Brewster reveals himself as an early advocate of visual education.

> The teacher, however wisely chosen and well qualified, has not at his command the means of imparting knowledge. He may pour it in by the ear, or extract it from the printed page, or exhibit it in caricature in the miserable embellishments of the school book, but unless he teaches through the eye, the great instrument of knowledge, by means of truthful pictures, or instruments, or models, or by the direct exhibition of the products of nature and of art, which can be submitted to the scrutiny of the senses, no satisfactory instruction can be conveyed. . . . The photographic process may be advantageously employed in producing accurate representations of those objects, both of nature and of art, which it would be desirable to describe and explain in the instruction of youth.[19]

Brewster also suggested the use of stereoscopic photographs for book illustration, and this idea was first put into practice in 1858 by the Astronomer Royal for Scotland.[20] In the same year a lending library for stereoscopic slides began operating in London. For an annual subscription of one guinea slides could be borrowed and exchanged as often as required.[21]

With increasing popularity, a lowering of taste set in; the stereoscope became the poor man's picture gallery. Comics and even mildly suggestive scenes appeared in the shops, along with love scenes, sets illustrating 'Married life and its pleasures', 'High Life and Low Life', and crinoline jokes. Pictures of social activities of the upper classes had the same function as some present-day Hollywood films–to give a glimpse of luxurious living to those farthest removed from it. Although the great majority of Pls 124, 125 these domestic scenes had to be staged (instantaneous photographs of such social events only became possible with the advent of the 'Ermanox' camera in 1925 in conjunction with fast panchromatic plates), their value as social documents is in no way diminished since they are contemporary and made for a public which would have been critical of anything but a true-to-life picture.

For a rather tasteless novelty–'ghost' pictures, which ten years later developed into 'spirit photography'–Brewster must bear the responsibility.

> For the purpose of amusement the photographer might carry us even into the realms of the supernatural. His art enables him to give a spiritual appearance to one or more of his figures, and to exhibit them as 'thin air' amid the solid realities of the stereoscopic picture. While a party is engaged with their whist or their gossip, a female figure appears in the midst of them, with all the attributes of the supernatural. Her form is transparent, every object or person beyond her being seen in shadowy but distinct outline.[22]

The trick was quite simply performed by letting the 'ghost' appear, suitably draped in a white sheet, for a part of the exposure only. The idea occurred to Brewster, he relates,[23] after seeing a calotype by Hill and Adamson of York Minster (1844) in which a boy had seated himself during part of the exposure on one of the steps near the doorway, appearing transparent in the print. 'The value and application of this fact did not at first present itself to me, but after I had contrived the lenticular stereoscope I saw that such transparent pictures might be used for various purposes.'

In 1862 the Stereoscopic Company paid £1,500 for the exclusive right to take photographs of the International Exhibition, and this task also fell to William England, who recorded the complete history of the exhibition from the opening ceremony to the dismantling. During that time (six months) the Company sold nearly 300,000 stereoscopic slides, besides many thousand carte-de-visite portraits made from England's negatives. The consumption of chemicals and other materials amounted to 70 reams of paper (1 ream=480 sheets), 200 gallons of albumen (made from 32,000 eggs), 2,400 oz. of nitrate of silver, 35 oz. of pure gold (made into chloride of gold for toning), 25 cwt. of fixing salt.[24] This was for the production of positive prints only, 95 per cent. of which were stereoscopic slides. In 1862 the instrument reached the zenith of its popularity, which declined with the craze for the carte-de-visite. In the late 1860s there was a general falling off of interest in photography, and in the 1870s and early 1880s photography went through a lean period.

Attracted by the simplicity of dry plates, roll-films, and small hand cameras, a large number of people found in photography a new hobby, and an amateur movement on a hitherto undreamed of scale began after the introduction of the Kodak in 1888. Almost simultaneously began a revival of stereoscopic photography, which had practically ceased to exist for the last twenty years. This second period of stereoscopy had its origin in England in 1887 and was largely stimulated by W. I. CHADWICK, secretary of the Manchester Photographic Society, by articles, lectures, and a manual (1890). From England the movement spread to France, where A. L. DONNADIEU and F. DROUIN published excellent treatises in 1892 and 1894 respectively. In the late 1890s three-dimensional photography had become big business again, but whilst the London Stereoscopic Company were now specializing in ordinary portraiture, three American firms, Underwood & Underwood, the Keystone View Company, and H. C. White & Co., captured the market with millions of views of every country and a multitude of events. Owing to the great technical improvements which had meanwhile speeded up photography, it was now possible to picture the life of the people, and events such as the Boer War, President Taft leaving the Capitol after his inauguration, and the Coronation procession of Edward VII. These stereoscopic pictures were no more expensive than photographic postcards today, and they are still to be found in many homes, together with the aluminium hand-viewer of the type invented by OLIVER WENDELL HOLMES in 1861, which was generally regarded as the simplest and best design for the examination of paper stereograms. It was mass-produced by Underwood & Underwood, for whom Holmes wrote a booklet (1898). Yet as suddenly as interest in stereoscopy re-awakened, it died down again, and by the outbreak of the First World War it was dead.

Anaglyphs. An entirely different system of stereoscopy must still be mentioned–the anaglyph process patented on 15 September 1891 by LOUIS DUCOS DU HAURON. In the anaglyph (Greek ἀνά = again, γλμφή= sculpture) the three-dimensional effect is attained by printing two pictures, taken with a binocular camera, on top of one another, one in red, the other in blue. The two dissimilar pictures naturally do not superimpose exactly. When viewed through spectacles with lenses of corresponding colours, but reversed, the pictures combine to a monochrome image in relief. Du Hauron acknowledged his indebtedness to the invention of another Frenchman, J. C. D'ALMEIDA (August 1858). Actually, it was much closer to the invention of a German, W. ROLLMANN (1853), for in d'Almeida's method the two stereophotographs were *projected* by two magic lanterns through a green and a red filter respectively, the audience viewing the screen pictures through spectacles in which the colours were reversed. Both du Hauron's and d'Almeida's processed have been repeatedly revived during the present century, the former particularly in 1924 by Léon Gimpel and Émile Touchet, who modified the colours to ruby red and bluish-green. Since then the anaglyph method has found commercial application from time to time, and in the 1950s was revived once more.

In J. ANDERTON'S projection method with polarized light (1891) the screen picture was viewed through polarized glasses, and this is one of the modern methods of making three-dimensional films.

STEREOSCOPIC AND OTHER SMALL CAMERAS

For outdoor scenes the binocular camera with lenses of short focus ($4\frac{1}{2}$ to 5 in.) taking two small pictures (each 3 in. × $3\frac{1}{4}$ in.) revolutionized photography in the mid-Victorian era, just as the miniature camera has done in our own time. Compared with the large field cameras with lenses of long focus, which had to be used with a small stop to secure perfect definition from foreground to distance, these short-focus lenses gave a sharp picture at almost open aperture, thus cutting down exposures drastically, and bringing for the first time 'life' and motion within the scope of photography, in instantaneous views of street life, seascapes with rolling waves, and ceremonies.

With scientific foresight Brewster had put forward his suggestion for a binocular or twin-lens camera as early as 1849–at the meeting of the British Association–but it Pl 121 was not until four years later that the optician J. B. DANCER of Manchester constructed the prototype.[25] Contemporaneously with this camera, which apparently did not go into production until the improved model of 1856, A. QUINET of Paris brought out the Quinetoscope, a binocular camera, which it seems was put on the market in 1853.[26] The binocular camera allowed the taking of both pictures simultaneously, and within a few years it superseded the slow single-lens stereo camera with which only still-life, architecture, and landscapes could be taken. In the single-lens type the Pl 122 whole camera was moved laterally along a groove after the first picture had been taken on one-half of the plate, and the other half of the plate was then exposed. The camera movement could be varied (laterally) to a length of up to 13 in. according to the distance of the object from the lens. Sir David Brewster and some other scientists advised, however, that the distance between the lenses should never exceed that between the pupils of the eyes–about $2\frac{1}{2}$ in.–and this was adhered to in Dancer's and all other good binocular cameras.

A 'pocket' stereoscopic camera was introduced by the London Stereoscopic Company in 1858. It was 8 in. long × $4\frac{3}{4}$ in. wide × 2 in. deep when folded up. It had a single lens and was so constructed that pictures could be taken up to a maximum distance of 6 in. apart. With focusing-glass and dark slide, the entire apparatus weighed only 19 oz.

Realization of the new fields opened up by the binocular camera led to the construction of fast single-lens miniature cameras for ordinary use. THOMAS SKAIFE'S pistol camera (June 1856) was the first of this type and was followed in July by a pistol camera of French origin, invented by M. MILLOTBRULÉ. Skaife's perfected 'Pistolgraph' (December 1858) was made of metal, and the instantaneous 'shots' were taken by means of a spring shutter worked by rubber bands which were released by a trigger. The plates were about $1\frac{1}{2}$ in. in diameter. Without going into details about the various improvements the camera underwent during the next few years, it may suffice to say that Skaife used a Dallmeyer combination portrait lens with a focal length of 1 in. and aperture of $\frac{7}{8}$ in., which could be reduced to $\frac{5}{8}$ in. by a stop, so that it worked at F. 1·1 or F. 1·6, and thus was one of the fastest lenses ever constructed. Rather incongruously, Skaife particularly recommended his revolver-camera for portraits of domestic pets and babies, claiming that 'every phase of infantine expression would be accurately depicted'. When he aimed his 'Pistolgraph' at Queen Victoria he was nearly arrested for attempting to shoot her; unfortunately this photograph was lost for ever when Skaife had to open his 'pistol' to convince the police that his 'shots' were harmless photographs. One devotee of Skaife's instrument, in Torquay, advertised himself as a 'Pistolgraphist'.

T. Morris of Birmingham on 30 August 1859 showed the photographic society there a tiny camera, measuring only 2 in. × $1\frac{1}{2}$ in. × $1\frac{1}{2}$ in., for taking pictures $\frac{3}{4}$ in. square, suitable for locket portraits or for enlargement. He called it appropriately a miniature camera.[27]

The first instrument that may be considered the forerunner of the modern small camera was ADOLPHE BERTSCH'S *chambre noire automatique* (July 1860). It was of the fixed-focus type like Skaife's (hence 'automatic'). All objects beyond a distance of twenty paces (about 40 ft) were rendered sharp, and this dispensed with a ground-glass for focusing. Instead, the camera, a 4-in. square metal box, was fitted with a frame viewfinder and a spirit-level. The lens, a single combination of 3 in. focal length, took pictures $2\frac{1}{4}$ in. square. There was no shutter, the exposures being made

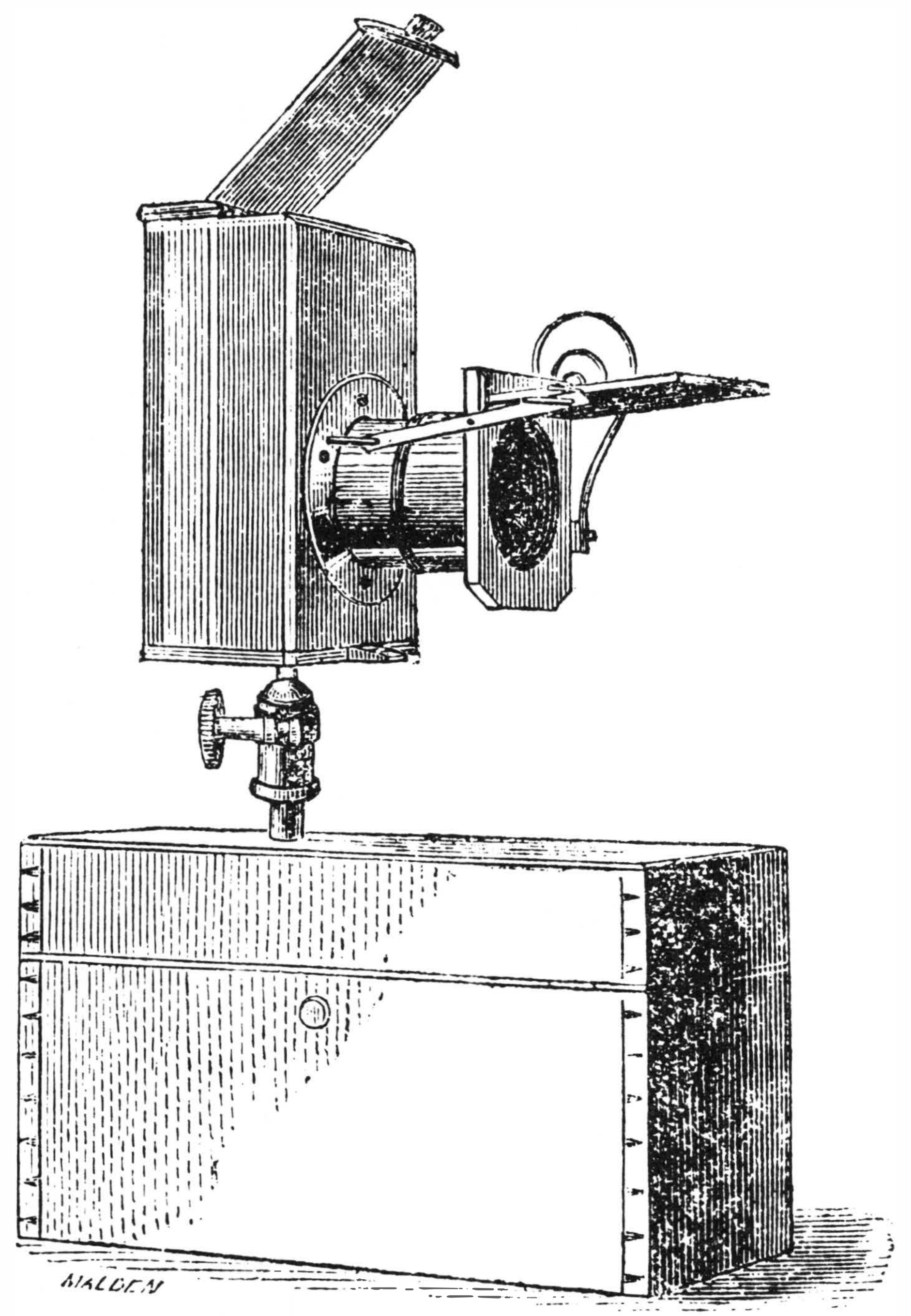


Fig 34 Ottewill's miniature camera, 1860

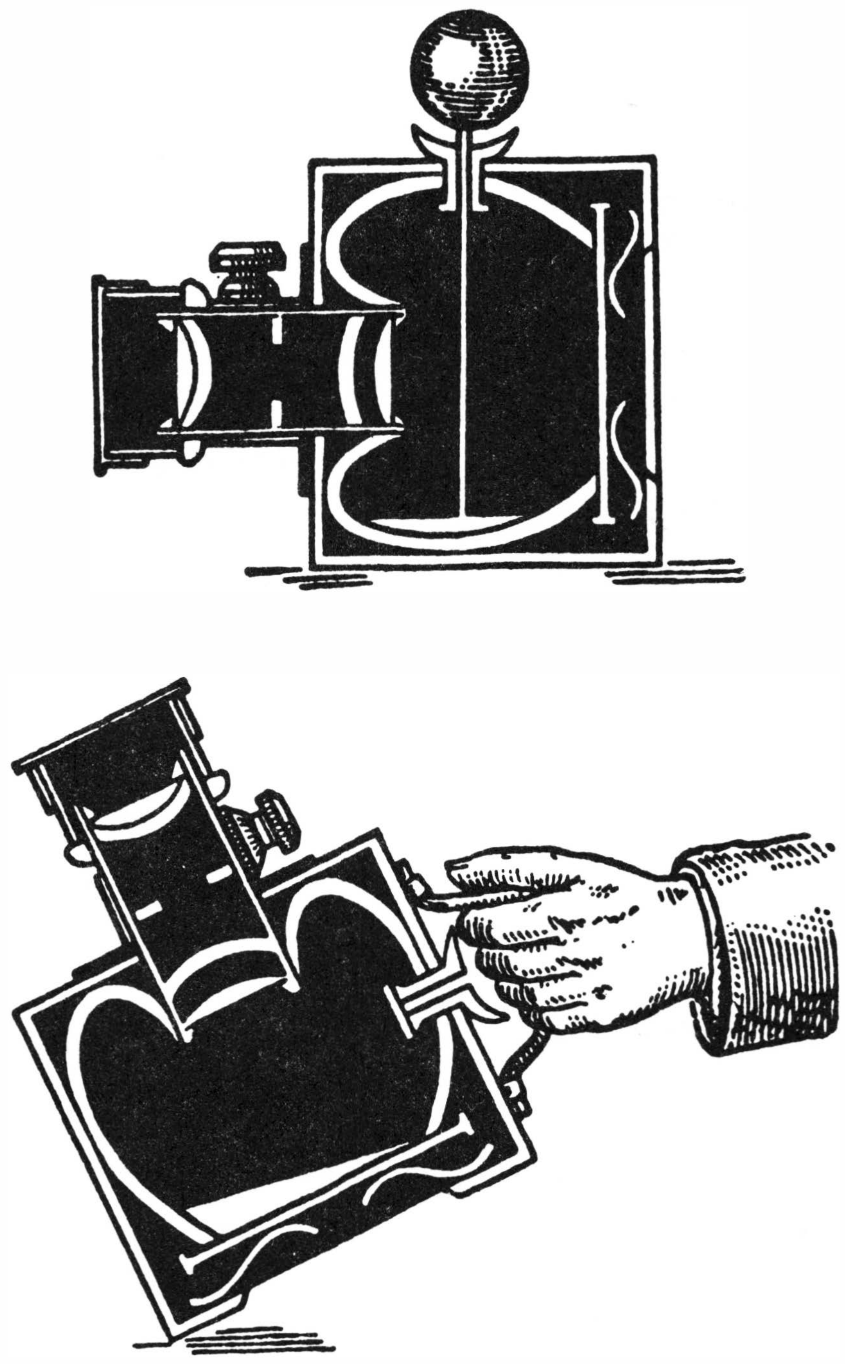


Fig 35 Dubroni's hand camera, 1864

by removing a lens cap. The camera was made for the wet collodion process, but albumen or dry collodion plates could also be used in conjunction with a changing bag. If used for the wet process, a small portable laboratory specially designed by the inventor could be provided, and the entire outfit, including camera, cost £8 10*s*. Bertsch stressed the importance of enlarging the small negatives either by projection on a screen or by printing on paper, and showed enlargements up to 26 in. × 17 in. produced in his 'megascope' (see chapter 26).

In the same year the English camera manufacturer OTTEWILL brought out a miniature camera made of mahogany, which packed into a box 5½ in. × 3½ in. × 3¼ in. Fig 34
The instantaneous shutter in front of the lens was actuated by a spring; the whole camera was obviously modelled on Skaife's.

In his patent of June 1851 FOX TALBOT put forward the suggestion of performing all the chemical manipulations within the camera itself. His instrument consisted of a glass cell or chamber into which the chemicals were introduced through a funnel and drawn off at the bottom by a stopcock. The idea then seemed so fantastic that it was regarded by photographers as a joke, and consequently never went beyond the specification stage.

Thirteen years later (1864) the French engineer DUBRONI introduced a very similar camera (English patent 21 December 1864). The sensitizing and developing Fig 35
of the plate were carried out inside the camera itself–a ruby glass globe encased in a box with an aperture for the lens and for the introduction of the plate. Through another opening at the top (with a light-tight valve), the solution was introduced by means of a pipette, the camera then gently rocked, and the solution removed in the same way. The camera was made in five sizes, the smallest taking pictures 2 in. square.

Of several other miniature cameras, the most original design was that devised by C. PIAZZI SMYTH, Astronomer Royal for Scotland, for photographing by magnesium light the interior of the Great Pyramid in 1865. It was a tin camera 8 in. × 3½ in.

square, but 6 in. of this was simply an extension acting as a shade against the light. The lens was a double combination of 1·8 in. focal length. Incorporated was the nitrate of silver bath made of ebonite in which a 3 in. × 1 in. plate (an ordinary microscope slide) was actually exposed through a 1-in. square window, which could be covered with a shutter, in one side of the bath. The plate had first been dipped in succession into a bottle containing iodized collodion and another containing nitrate of silver solution, and after exposure in the small silver bath, it was dipped into bottles containing developing and fixing solutions, and water. All danger of the collodion drying quickly in the hot and dusty atmosphere of the Pyramid was thus obviated.[28] Piazzi Smyth stressed the advantages of the small negative over the larger, and described[29] the process of enlarging the tiny plate which he–like Skaife and Bertsch before him–with foresight regarded as the ideal procedure.

Bryceson of Edinburgh later brought out an improved model with a square revolving silver bath, each side of which carried a plate, so that four exposures could be made one after the other.

In 1868 C. D. SMITH designed a pocket camera which was manufactured by Negretti & Zambra. It was a bellows camera made to take 3¼ in.× 3½ in. plates, the external dimensions being 4¾ in.× 4⅜ in.× 1⅞ in. when folded. It weighed only 13 oz. and was used with a walking-stick tripod stand. For the convenience of focusing without a cloth, a tin hood was fixed to the focusing-glass and fitted with a magnifying lens in order to be able to focus with the greatest accuracy. Other forms of pocket cameras for use with collodion-emulsion dry plates not exceeding 3¼ in. square and with walking-stick tripod were introduced in 1861–9 by the following British makers: Ross & Co., Murray & Heath, Ernest Edwards (all of London), and J. Lancaster of Birmingham.

About the same time, Nicour's opera-glass camera, patented by H. Cook in May 1867, made its appearance. It had two identical lenses, one for focusing, the other for taking; but instead of the lenses which are always at the front of an opera-glass, one side was fitted with a ground-glass for focusing the picture, and the other side had attached to it a cylindrical plate magazine holding up to fifty collodion dry plates, each 4 cm.×4 cm.

All these ingenious instruments, the forerunners of our present-day miniature cameras, were exceptions made to suit special needs. Small negatives depended on subsequent enlarging, which at that time only added to the difficulties of photography, being a slow procedure and requiring sunshine. The majority of photographers continued to lug about big plate cameras, some of which will be discussed in chapter 23.

21 *Instantaneous photography*

The inability of the early daguerreotype to record action was disconcerting to its inventor. In a view of a Parisian boulevard which he took in 1839 none of the busy traffic was recorded and the only pedestrian visible is a man having his boots cleaned, which had caused him to remain in the same spot for most of the exposure. After chemical acceleration of the process in 1841, Daguerre optimistically informed Robert Hunt that it would now be possible 'to fix the images of objects in motion, such as public ceremonies, market places covered with people, cattle, etc., the effect being instantaneous'.

In chapters 10 and 13 we have mentioned some instantaneous daguerreotype views taken by M. A. Gaudin, Girault de Prangey, Hippolyte Macaire, and the Natterer brothers. These pictures were taken on a small plate and from a high vantage point to minimize the movement of pedestrians and traffic, which was taken moving towards or away from the camera, not laterally. Whilst these daguerreotypes remained isolated instances, curiosities almost, proving that it could be done, instantaneous photography began in earnest only during the collodion period and in conjunction with stereoscopic cameras, since it was now possible to get a magnified and very lifelike appearance of the small pictures in the stereo viewer. The stereo views of the Boulevard Montmartre with traffic which Disdéri took in 1854 were the first of their kind,[1] but the popularity of street views only set in five years later, when the pictures had become more effective through being taken from the first floor windows instead of higher up. GEORGE WASHINGTON WILSON's lively views of Princes Street, Edinburgh, were taken from the first floor balcony of an hotel in 1859, and rank as the first really successful photographs of street scenes with people and traffic not blurred, and yet not too small. They are full of activity. 'How infinitely superior to those "cities of the dead" ', wrote a reviewer, 'with which we have hitherto been compelled to content ourselves.'–a remark which makes the difference clear. Wilson's Princes Street pictures were followed the same year by similar ones of Broadway, New York, by EDWARD ANTHONY, one or two being daringly taken even on a rainy day: the slightly blurred bus in the foreground actually enhances the effect of movement. The following year appeared street views of Paris by ADOLPHE BRAUN and WILLIAM ENGLAND, and after that pictures of other capital cities followed each other in rapid succession, always taken from carefully chosen vantage points in buildings. Pl 126 Pl 128

In 1862 VALENTINE BLANCHARD went a step further by going right into the London traffic in a cab fitted up as a darkroom. Perching himself with his camera on the roof, he was able to capture extremely lively impressions of the hustle and bustle of the great city. The immense traffic that even in those days congregated at the Royal Pl 127

Exchange and the Bank of England made it difficult for Blanchard to find a suitable place to stop the cab. One day he made the attempt at the corner of Cheapside. With palpitating heart he was preparing the plate, when he heard a policeman challenge the cabby, who promptly offered this explanation for stopping so long: 'He's a gentleman employed by the Government. We are going to the Tower after this. We start from the Horse Guards every morning. You just watch him when he comes out. Won't he astonish you!' When Blanchard got out of the cab he found himself in the middle of Cheapside with the whole of the traffic stopped and several policemen in attendance. 'With fear and trembling I mounted to the roof and made the exposure. The picture was a success, and I drove away a happy man.'[2]

Pl 129 The people listening to an election speech at Dover on a rainy day in 1864 presented an exceptionally difficult subject for the (unknown) photographer, for in order to capture a feeling of involvement, which is lost if viewed, as it were, through the wrong end of a pair of binoculars, he took up his position on the outskirts of the crowd.

Strange as it may seem, to record clouds presented greater problems than crowds, for the contrast between the green of grass and foliage, to which the then colour-blind negative material was not very sensitive, and the blue sky, to which it was over-sensitive, was too great. If exposed for the sky, the foreground became a mere silhouette; if the exposure was correct for the landscape, the sky was so dense that it printed white, and any clouds there may have been had moved. Bisson's correct suggestion in 1844[3] of the use of a green filter for landscapes could not be followed on account of the resulting greatly increased exposure. The impossibility of obtaining a harmonious fusion of sky and landscape was a general complaint in the 1850s and 1860s. Understandably, reports that Hippolyte Macaire–who had by this time given up the daguerreotype in favour of collodion–sold 18 × 24 cm. prints of seascapes with rolling waves and floating clouds and ships in motion[4] at 20 francs each was regarded by the English with incredulity. Even when they saw at the Photographic Society of London's annual exhibition in December 1856 a similar picture by Gustave Le Gray entitled 'Brig upon the Water'[5] they could not believe that the clouds had not been printed in from a separate negative. The *contre-jour* effect, and the passing gleam of light on the water produced by a momentary opening in the clouds, aroused the wonder and envy of all photographers who saw this picture at the many exhibitions in which it was subsequently shown. The 'moonlight' effect, which has since been imitated countless times, was due to the necessary under-exposure. The secret of Le Gray's–and Macaire's–success lay simply in the fact that the luminosity of the sea was not much less than that of the sky, and those who hoped to imitate this effect with an ordinary landscape were disappointed. Hitherto, the problem of blank skies had been overcome by blacking out the sky on the negative so that it appeared uniformly white in the positive, but after seeing Le Gray's picture photographers were no longer content with a plain sky, and dabbed artificial clouds on the negatives. This was done by reducing the sky with cyanide of potassium or by painting on clouds with Indian ink. By the first method dark rain clouds were obtained, by the second, white cumulus clouds. This technique was suggested by Sir William J. Newton to the Photographic Society of London in February 1853. Camille Silvy, whose landscapes were highly praised at the Salon of 1859, overcame the difficulty by taking two negatives for each view: the landscape, and the sky with clouds,[6] a technique that had been suggested seven years earlier by Bayard.[7] Pl 131

This brought a new difficulty in its train, the horizon line, for it needed careful masking to avoid overlapping of sky and scenery. Favourite cloud negatives were made to do duty for totally different subjects, sometimes with incongruous results: a dramatic cumulus cloud might serve for an Alpine scene, an English cathedral, and the Pyramids alike. Still more absurd was the fact that different photographers might be using the same negative, for from 1880 on they became an article of commerce.

In Britain GEORGE WASHINGTON WILSON of Aberdeen took the earliest instantaneous views. Like many other miniature painters, Wilson had found portrait photography, which he took up in 1851, a more lucrative pursuit than painting. Though well known locally as a portraitist (he was appointed Photographer to Her Majesty in Scotland), Wilson's international repute was due to his landscapes, and in particular to his instantaneous stereoscopic views. The Loch of Park (July 1856) photographed Pl 132
against the setting sun gave the same striking representation of water and sky as Le Gray's picture. But being taken with a stereoscopic camera, the picture was too small for exhibition, and did not become known until 1859, when Wilson published a series of stereoscopic views entitled 'Scottish Gems.'

Wilson did not devote himself exclusively to the beautiful scenery of his native Scotland. His 'Waiting for the boat' (1857), showing the crowded pier at Greenwich, Pl 130
is another instantaneous 'gem'. On the same trip south he secured the first photographs of battleships afloat, and on the recommendation of the Queen the First Lord of the Admiralty made special arrangements to fire whole broadsides as well as single shots for Wilson's sole benefit. His photographs showing the puffs of smoke at the mouths of the guns were viewed with astonishment by naval experts as well as by the general public when they were put on the market. Wilson said modestly: 'These effects can be caught by anyone, without peculiarly sensitive or secret preparations of collodion and nitrate bath, and without any super-excellent lenses, but considerable watching and waiting is necessary before an effect turns up which is both capable and worthy of being taken, and when it does turn up, one must be ready to do it *at once*, or presto! it is too late!' About exposure, he said that he had never managed to reduce it to less than $\frac{1}{6}$ second, and then only when sky and water formed the principal part of the subject. The chief difficulty in taking instantaneous views was that no automatic shutters existed. Wilson's method was to remove dexterously the two connected cardboard caps from the twin lenses with one hand, and to re-cover them quickly with his Glengarry bonnet with the other.[8]

The instantaneous sea and cloud studies with imitation moonlight of CHARLES BREESE, a Birmingham photographer, drew crowds to the stereoscope stands at the International Exhibition in 1862. 'Every drop of water in the waves dashing and breaking against the rock and tumbling headlong into the foaming cataract; the sea-gulls skimming across the wave, the ocean lashed into turbulence by the tempest, rare sunset and moonlit views, are amongst his triumphs', wrote Dr Diamond in reviewing the section. Four years earlier Breese had become noted for his street views on the occasion of Queen Victoria's visit to Birmingham (August 1858), and he was asked to send copies to Windsor for the Queen's collection.

THOMAS SKAIFE took several stereoscopic pictures for the War Office in the summer of 1858, including one showing the trajectory of a 36-in. shell fired from a new giant mortar, which was regarded as a new advance in photography.

P. Barry's book *Dockyard Economy and Naval Power* (1863) is illustrated with 31 photographs of dockyards and steelworks, and constitutes one of the earliest applications of photography to industry. The pictures were taken by an unnamed photographer using a small camera. The considerable difficulty of photographing men at work in interiors was successfully overcome even a few years earlier by the REV. Pl 133
THEOPHILUS SMITH, who took a number of stereographs of similar subjects.

22 *News photography*

Many people are under the impression that news photography is a twentieth-century application, only made possible by hand cameras, miniature cameras, roll-films, and fast plates. But this is not so. As early as the 1840s photographers tried to record public ceremonies and other events, but success depended on favourable light conditions and the avoidance of moving people. More or less instantaneous photographs could not be taken until the mid-1850s.

The earliest news photographs were daguerreotypes of the Hamburg fire, 1842 (see page 159). We have also mentioned in chapter 11 a news photograph of P. D. Babbitt in 1853. In that year **GEORGE N. BARNARD** made a dramatic daguerreotype of burning grain silos at Oswego, N.Y. Though very few such pictures have survived, the daguerreotype was occasionally employed more or less successfully to record scenes of topical interest, when the photographer could take up a position at a considerable distance from the scene.

The Duke of Wellington's funeral on 18 November 1852 is, as far as is known, the first public ceremony of which a photographic record was attempted. Unfortunately it was too late in the year for success. The difficulty of recording action and movement in public scenes and ceremonies had hitherto discouraged photographers, and occasions such as the opening of the Great Exhibition in Hyde Park by Queen Victoria on 1 May 1851 must be regarded as one of photography's lost opportunities.

When at last the enlarged Crystal Palace at Sydenham was reopened by the Queen, on 10 June 1854, the ceremony was recorded by several photographers. The Queen, the King of Portugal, Prince Albert, and other members of the royal family were seated on a dais under a canopy. Behind them were three bands and a choir of 1,800 who sang the Hallelujah chorus. An opportunity to take photographs occurred during the Archbishop of Canterbury's prayer. In addition to **JOSEPH CUNDALL** and
Pl 135 **P. H. DELAMOTTE**, the Stereoscopic Company had a photographer present, who made his exposure while the chairman of the Crystal Palace Company read an address to the Queen; and **T. R. WILLIAMS** took three daguerreotypes, each 3 in. × 5 in., which he exhibited the same evening at the Royal Society's soirée. Unfortunately only one of these daguerreotypes has so far come to light, and probably a large number of other early news photographs have disappeared, except such as were made by the collodion process, from which prints were published.

The state visit to London of Napoleon III and the Empress Eugénie, and the grand ceremony which took place in their honour at the Crystal Palace at Sydenham on
Pl 136 20 April 1855, presented a memorable opportunity for photography. **NEGRETTI & ZAMBRA**, who held the monopoly for photography at the Crystal Palace, had several

cameramen, including Delamotte, at work on a stage erected in a gallery opposite the royal dais, where they waited for a quiet moment in the proceedings. In the front row on the dais we see from left to right Napoleon III, Queen Victoria, the Empress Eugénie, and Prince Albert. The sculpture in the background is a copy of one of the horse-tamers outside the Quirinal in Rome, and had previously been shown at the Great Exhibition in Hyde Park.

The following year Victor Plumier, Marville and Mayer & Pierson recorded the arrival of the Emperor's carriage and the scene outside Notre Dame at the baptism of the Prince Imperial. Also in 1856 we hear of photographs taken by Baldus and Ferrier of the devastation caused by the floods of the Rhône and Loire, respectively.

During the attempt to launch the *Great Eastern*, the largest steamship of the century, in November 1857, ROBERT HOWLETT used a trick often employed by modern photographers on similar occasions: instead of focusing on the leviathan, he caught the tense expression of those responsible for her–the engineers John Scott Russell, Henry Wakefield, and I. K. Brunel–anxiously watching as she was lowered sideways into the water. In another picture of Brunel standing in front of the launching chains Pl 134
Howlett approached the subject like a modern reportage photographer.

Garibaldi, the creator of united Italy, in 1862 opposed the Government he had helped to establish, and on 29 August he and his followers were defeated at Aspromonte, after a short skirmish in which Garibaldi was wounded and taken prisoner. When his medical attendant Dr Nélaton announced that it would not be necessary to amputate his leg, a clever Italian photographer sensed that there was money in this news, and hundreds of copies of his photograph were sold to Garibaldi's sympathizers.

Numerous other historic events were photographed during the collodion period, such as the execution of the Emperor Maximilian of Mexico 1867, the Abyssinian war 1868, the completion of the first U.S. trans-continental railway and the opening of the Suez Canal 1869, the fall of Rome 1870, the Chicago fire 1871, and the construction of the St Gotthard railway tunnel 1872–82.[1]

EARLY WAR PHOTOGRAPHS

The Crimean War. While the state visit of the French Imperial couple and the return visit of Queen Victoria and the Prince Consort were consolidating the military alliance between the two nations, ROGER FENTON, a barrister and founder of the Pl 138
(Royal) Photographic Society, was occupied taking photographs in the Crimea, where the British and French armies were allies of the Turks. Photographing the war was an arduous undertaking, for the subject-matter was totally unfamiliar and the climatic conditions extremely trying.

The Crimean War was the first to be covered in the current sense by newspaper reporters, by war artists, and by photographers. Roger Fenton's name, like that of (Sir) William Howard Russell, correspondent of *The Times*, will always be linked with the Crimea, for it was their dispatches in word and picture which brought the war home to people who were accustomed to rely on the bleak information given by casualty lists and military intelligence.

Russell's revelations in the winter of 1854–5 of the appalling conditions suffered by the troops, roused the anger and the conscience of the nation, and deeply undermined confidence in the Government. Denials and explanations were of no avail: the official casualty lists bore out Russell's reports. Only one-eighth of the casualties died of wounds, the rest succumbed to cholera or to the hardships of the intense cold. In February 1855 Lord Aberdeen's Government was forced to resign.

Whether Roger Fenton's expedition to the Crimea in the same month had any political significance or was merely a commercial enterprise is difficult to judge. The expedition was made under royal patronage and with the assistance of the Duke of Newcastle, the Secretary of State for War–which suggests a political motive. On the other hand, it was financed by the Manchester publisher Thomas Agnew, who wanted pictures of the troops and their leaders and scenes likely to be historically interesting. But whether government or publisher was primarily responsible for Fenton's mission, it is clear that it was intended that he should avoid portraying the ravages of war or anything likely to upset people at home; and it is in this light that we have to view Fenton's entire opus of 360 Crimean photographs; for herein lies the key to the otherwise puzzling fact that these first war photographs are not very war-like. The contrast between his photographs and Russell's reports is striking. There are no horrifying pictures of prostrate bodies lying in the field, but Pl 139 'A Cantinière Tending a Wounded Man', 'The Sanitary Commission', 'The Cookhouse of the 8th Hussars', 'A Quiet Day at the Mortar Battery', a convivial party of French and English officers entitled 'L'Entente Cordiale', a 'Regiment in sheepskin coats ready for the trenches'. Photographs like these were more powerful proof than words that some of the remedies Russell had called for had been put into effect, and they reassured the public that at last the men were properly cared for after their terrible Pl 140 sufferings in the preceding winter. They are also superb as photographs.

Though often spoken of as 'the first war photographer' this designation does not, strictly speaking, apply to Fenton, but to CAROL POP DE SZATHMARY, an amateur artist and photographer living in Bucharest, who, soon after the outbreak of the war in Wallachia in November 1853, photographed the Russian generals and camp scenes, and later on, the Turks, following the warfare in the Danube valley[2] in his carriage, which he had fitted out for photography. His adventures are not unlike some of Fenton's experiences, for his carriage sometimes drew the enemy's fire, and on one occasion a cannon ball tore up the ground a few paces away.

At the Paris Universal Exhibition 1855 de Szathmary showed an album of 200 photographs in the Turkish department, where it was much admired. Napoleon III encouraged him to publish it and headed the list of subscribers.[3] In July de Szathmary presented an album to Queen Victoria during a private audience at Osborne, in the presence of Prince Albert and King Leopold I of the Belgians.[4] The intended publication of these war photographs was not realized, however, and de Szathmary's work has disappeared without a trace.

When the British and French entered the Crimean War on the Turkish side, RICHARD NICKLIN, a Manchester portrait photographer, was attached to the British army, but he and two corporals who assisted were lost when the *Rip van Winkle* foundered off Balaclava in a hurricane in November 1854. The War Office then selected two young officers, Ensigns BRANDON and DAWSON, who, after a month's training from J. E. Mayall, were despatched to Sebastopol early in the spring of 1855 with fresh photographic supplies and apparatus. However, no trace has been found of their photographs.[5]

Fenton travelled to the Crimea in an entirely private capacity. Having frequently photographed the royal family, he was well provided with letters of introduction from Prince Albert to Governors and Ambassadors on the route, and to the Commanders in the field, by whom he was in consequence treated as an equal, enjoying their hospitality whenever his work took him to the camp of the one or the other. Pl 137 He embarked on 20 February 1855, taking with him a photographic van and two assistants–a driver, and MARCUS SPARLING, a former corporal, inventor of an ingenious camera and author of a comprehensive textbook on photography (1856). Both assistants and the photographic van had already been employed by Fenton the previous autumn on a photographic tour in Yorkshire. Originally a wine-merchant's vehicle, Fenton had it converted into a caravan fitted up for living, cooking, sleeping, and darkroom work. His immense quantity of equipment filled no fewer than 36 large cases, and included five cameras of various sizes, a stock of about 700 glass plates, chests of chemicals, a tent, carpenters' tools, cooking utensils, tinned food, harness for three horses, and many other items.

Arriving at Balaclava on 8 March, Fenton at once experienced that extraordinary lack of co-ordination which was typical of the whole campaign. Merely to get the van and equipment disembarked meant spending a week running from the admiral to the captain of the port and from him to the captains of the ships in the harbour. 'I saw', he wrote, 'that if I could get none but official assistance, Sebastopol would be taken probably by men and arms, but not by photography.' When he finally disembarked, by private enterprise, the difficulties began all over again with the allocation of a hut to store the equipment, fodder for the three horses he had bought in Gibraltar, and the acquisition of a saddle. Little wonder that the exasperated photographer gave vent to his feelings in a letter to his publisher: 'I don't think, if I could have foreseen all the difficulties of my task before setting out, that I should have had the courage to come, but by pitching into them one by one, I suppose they will be mastered.'[6]

To avoid the necessity of explaining the purpose of the carriage, the words 'Photographic Van' were painted on it in large letters, with the result that crowds of all ranks flocked around. 'Everybody is bothering me for their portrait to send home', Fenton complained. 'My hut seems to be the *rendezvous* of all the colonels and captains in the army; everybody drops in every day and I can scarcely get time to work for questions.'

The labour itself was great, and from the end of April the heat was almost unendurable. 'As soon as my van door was closed, perspiration started from every pore.' One day when the door was left open, the sun shining into the van blistered a gutta-percha funnel 'as if it had been laid on the hot bars of a fireplace.' By the beginning of June, Fenton had to stop working by ten o'clock in the morning, for quite apart from the fatigue, it was impossible to take good portraits after that hour, 'for the glare was so great from the sky and burnt-up ground, no one could keep his eyes more than half open'. General Pélissier was photographed at 4 a.m. on the morning of the taking of the Mamelon, and the famous 'Council of War' showing the three Commanders-in-Chief of the Allied armies in consultation, Lord Raglan, Omar Pasha, and General Pélissier, was taken directly afterwards.

To the sheer physical discomfort of working in the intense heat in the stuffy van, aggravated by dust and a plague of flies, was added the technical difficulty of coating the plates; for, with the larger plate sizes (12 in. × 16 in. and 14 in. × 18 in.), the collodion would sometimes dry before the liquid had time to spread evenly over the plate, and often the coating became nearly dry in the short time necessary to take the slide containing the plate to the camera and back, and many pictures were spoiled.

Exposures for large plates were 10 to 20 seconds. The shortest possible exposure was 3 seconds for a smaller picture (8 in. × 6 in. camera). Instantaneous views were therefore ruled out, and Fenton had to watch for a quiet moment, or to arrange groups to convey the impression of being an instantaneous snapshot.

Going up to the English and French lines of attack was not only arduous on account of the great distances and numerous ravines, but even dangerous, for owing to the bareness of the country Fenton's van stood out visibly for miles, and, being such an easy target, on several occasions it drew the fire of the Russian batteries, who doubtless thought it was an ammunition wagon.

When Fenton heard that the big attack on Sebastopol, which everyone was confident would succeed, was at last to take place on 18 June, he made full preparations to photograph the town and the Russian forts that had withstood the siege so long. However, the attack failed, and as there was no talk of a fresh assault soon, he 'felt quite unequal to further exertion, and gladly embraced the first opportunity of going home'. He sold the van and horses, and on 26 June embarked from Balaclava, a sick man: while living at Headquarters he had been infected by a fresh outbreak of cholera, to which Lord Raglan, General Estcourt, and many others succumbed within a few days of his departure.

It is some proof of the importance of Fenton's work and the general interest it aroused that he was commanded to Osborne for an audience with the Queen and Prince Consort directly after his arrival in England. He was still so weak that he was granted the unusual privilege of lying on a couch in the royal presence.

When fully recovered, he had at St Cloud two audiences with Napoleon III, who joined Queen Victoria and Prince Albert as patron of the publication of the Crimean photographs, for Fenton had not confined himself to picturing the British forces in the Crimea but had also substantially covered the interests of their allies.

Fenton's photographs were published in five portfolios entitled *Photographs taken under the patronage of Her Majesty the Queen in the Crimea by Roger Fenton, Esq.*, Agnew & Sons, Manchester (1855). They were grouped under 'Incidents of Camp Life', 'Historical Portrait Gallery', 'Views of the Camps', and panoramas of Sebastopol and Balaclava.

In the first days of September JAMES ROBERTSON, superintendent and chief engraver of the Imperial Mint at Constantinople, arrived at Balaclava accompanied by his assistant FELICE A. BEATO, a Venetian by birth and a naturalized British subject. He covered the same ground as Fenton, but the chief value of his sixty or so photographs lies in the fact that they form a continuation of Fenton's series, and complete the photographic documentation of this most irresponsible war. Sebastopol fell on
Pl 141 8 September and Robertson caught the indescribable confusion in the Redan after the retreat of the Russians, recorded the bomb-proof shelter of the Russian generals, the French telegraph station erected on the remains of the Malakoff tower, the French trenches between the Mamelon and the Malakoff forts, and above all the ruins of Sebastopol, its docks and forts, and the bridge of boats across which the Russians had retreated.

Both Fenton's and Robertson's photographs–the latter taken by the albumen-on-glass process–aroused immense curiosity when exhibited in London in October 1855 and February 1856 respectively. Nevertheless, interest in the war which was never a popular one with the British public, faded so rapidly that already in December 1856 Fenton's and Robertson's negatives and stocks of unsold prints, as well as nearly 2,000 remaining copies of William Simpson's *Seat of War in the East* illustrated with lithographs from his sketches, were sold by public auction.

Robertson and Beato then continued their series of views of Mediterranean cities and antiquities, started before the Crimean War: Constantinople (1853), Athens
Pl 149 (1854), Malta, Cairo, and the biblical sites in Palestine. After this they went to India, probably roused by news of the Mutiny, 1857. Owing to the comparatively long exposures necessitated by the large view-cameras (10 in. × 12 in.), no action shots in the modern sense could be attempted, but they did nevertheless record scenes such

as the blown-up Kashmir Gate at Delhi, the hanging of two rebels, and the Siege of Lucknow, when the last Sepoy stronghold, the Secunderabad, was captured. Pl 142 The printing and distribution of their photographs was undertaken by Shepherd in Simla–a firm founded in 1843, and the oldest photographic business in India. It is not always possible to establish which photographs are by Robertson and which by Beato, as they seem to be indiscriminately signed by either or both. To add to the confusion, some of Beato's pictures are signed with the initial A and others with the initial F.[7]

Robertson remained in India as partner of Shepherd and concentrated on photographing the British Army in India. The younger and more adventurous Beato attached himself to the Anglo-French campaign against China and made a valuable documentation of the chief events during the conclusion of the Opium War: the capture of Fort Taku, Tientsin, by the British and French fleets in August 1860, Pl 143 showing the horrifying scene immediately after the allies had scaled the ladders, and the destruction of the Imperial Summer Palace near Peking in October.

In 1862 Beato became one of the first European photographers in Japan, supplying an eager British public with views of this recently opened-up country. Eight years later he returned to China where a fresh outbreak of anti-foreign feeling had led to more massacres. Finally, in 1884–5 he covered the Sudan campaign of General Wolseley for the attempted relief of General Gordon at Khartoum. Thus Beato more than any other nineteenth-century photographer concentrated on the documentation of violent events.

About the period that Robertson and Beato were photographing in India, Ferrier & Soulier and Bérardy accompanied Napoleon III's campaign as ally of Victor Emmanuel II against Austria (1859). Taking stereo-photographs, they were able to record–according to contemporary reports–a certain amount of action such as the Emperor's arrival at Genoa, the departure of the French troops for Magenta, and scenes of camp life. Unlike Fenton, they did not shirk gruesome subjects such as corpses and piles of amputated limbs.[8]

The American Civil War. At the outbreak of the war MATHEW B. BRADY was proprietor of the leading portrait studios in America–on Broadway, New York, and in Washington (see chapter 25). He had built up a kind of Pantheon of celebrities and made a fortune in the process. Convinced that 'the camera is the eye of history', Brady felt impelled to document the conflict taking place on his native soil, and when Lincoln warned him that the Government had no money for the project, he decided on the undertaking as a commercial enterprise financed by himself. He equipped a number of photographic teams with dark-room wagons and eventually had twenty Pl 145 photographers in the field, including himself, operating in almost every theatre of the war. Best known of these is ALEXANDER GARDNER, a Scot who had emigrated to America in 1856 and two years later was engaged by Brady as manager of his Washington studio. However, in May 1862 he left Brady and opened his own portrait gallery in Washington. Eight months later he was appointed photographer to the Ordnance Department of the Army of the Potomac, with his son James as assistant. The cause of the rupture with Brady was the latter's insistence on putting his name alone on all photographs supplied to newspapers, though only comparatively few had actually been taken by him. This, of course, was his right and the general practice of all employers.

Photo-copying maps for the army left Gardner ample time for war photography. Chief among the photographers working for him was TIMOTHY H. O'SULLIVAN, his former assistant in Brady's Washington studio. Ironically, the photographs of the

Gardner team are better known today than those of the Brady team. Gardner was quick to publish two volumes each containing 50 original prints, nearly half of them acknowledged to O'Sullivan, accompanied by text.[9] They contain among others the Pl 144 historic photograph of President Lincoln visiting the Headquarters of the Army of the Potomac in October 1862, a group which includes the Commander-in-Chief, General George B. McClellan, whom Lincoln relieved of the High Command the Pl 146 same day. O'Sullivan's most famous picture, 'The Harvest of Death', was taken the morning after the Battle of Gettysburg, July 1863, and is an unforgettable record of Pl 147 the horrors of war. Horrifying in a different way is Gardner's photograph of the execution of the conspirators against Lincoln, who were hanged in the Washington Penitentiary yard in July 1865.

Brady had sunk a fortune of $100,000 (then about £25,000), some of it borrowed, in his war recording organization, and despite the fact that his portrait studios were still churning out carte-de-visite portraits by the thousand he was reduced to financial ruin by the end of the war and forced to sell his New York studio. His ability to sell prints to the public was greatly limited by the fact that he had ceded to the New York firm of Edward Anthony & Co. a set of several thousand duplicate negatives, together with their copyright, in settlement of a debt of $25,000 for photographic materials supplied to him. Whilst Anthony did excellent business for some years with the sale of prints from these negatives, the commercial value of Brady's own set–and each subject had been taken twice or even three times in 8 in. × 10 in. and stereo size–had thereby been greatly reduced and even its historic importance was naturally diminished by the fact that the set was not unique. Brady's confidence that the Government would buy his set of negatives proved unfounded, for there were now urgent problems of reconstruction to be faced. No action was taken either when in 1871 the Library of Congress recommended the purchase of 2,000 of Brady's national portraits. Three years later, to recover storage charges, 6,000 out of the 8,000 war negatives were disposed of by auction and acquired by the U.S. War Department by defraying the amount due. There they lay completely neglected for many decades until transfered in the 1930s to the National Archives in Washington. Though Congress paid Brady $25,000 for the copyright of these 6,000 negatives (which had been appraised at $150,000 by General, later President, Garfield), even this was only a token sum. After the closing of his New York studio Brady had moved to Washington where he continued his portrait studio assisted by his nephew by marriage, Levin C. Handy. He died in the poor ward of a New York hospital in 1896, embittered and disappointed at the indifference shown towards the record which he had anticipated would be treasured in American history–as indeed it is today.

During the Second World War the Library of Congress acquired the neglected and forgotten hoard of nearly 10,000 war negatives 'stored since 1916 in a basement vault next to the coal-bin'. This stock includes the negatives acquired by Anthony, and others by Gardner and his staff. More recently the Library bought another 3,000 negatives belonging to Levin C. Handy, chiefly portraits of celebrities, and thus became the largest depository of Brady material[10] over eighty years after it had been first suggested.

Brady was brilliant as an organizer rather than as a photographer. He assembled an almost complete pictorial record of the Civil War from the Union side, but out of the thousands of negatives taken, only the extremely small number of 84 could be ascribed to him with certainty by James D. Horan.[11] The general tendency to label *all* Civil War photographs as Brady's work may be partly due to ignorance and partly to a desire to make amends for past failure to recognize the historic importance of his self-imposed task. In any case, the aura surrounding Brady is quite disproportionate to his merits as a photographer. Among his best-known pictures are the Battle of Bull Run (the first action of the war), the group of General Robert E. Lee, Commander in Chief of the Confederate Army, with his son and aide-de-camp on the porch of Lee's house after his surrender, and the ruins of Richmond, Virginia. Pl 148

Mention should still be made of GEORGE N. BARNARD, who covered General Sherman's campaign in the South and published 61 photographs in an album entitled *Photographic Views of Sherman's Campaign*, New York, 1866. Other photographs by Barnard are included in Gardner's album.

Comparatively little has so far been published about the Civil War photographers on the Confederate side, with the exception of Michael Miley, one of the less important.[12] The more prominent photographers were GEORGE F. COOK of Charleston, A. D. LYTLE of Baton Rouge, EDWARDS & MCPHERSON and OLIVER of New Orleans. All were greatly handicapped in their work, for their photographic supplies came–like those of the Union photographers–from Anthony's in New York, and had to be smuggled in.

The ten volumes of *The Photographic History of the Civil War*–a monumental work containing half-tone reproductions of a very large number of photographs–remains to this day the best source-book on this episode in American history,[13] though no attempt was made–perhaps because it proved an impossible task–to credit the pictures to individual photographers.

Wars have always provided exciting picture material for any photographer prepared to risk his neck and take a gamble on selling his pictures to newspapers and the public. Strange as it may seem, it was not until the First World War that photographers were for the first time officially attached to the armed forces as war reporters. Until then, they covered a war either at their own expense, or in the employment of a newspaper or publisher. This also accounts for the fact that so comparatively few pictures have been preserved of smaller conflicts such as the German-Danish War of 1864 and its continuation the Seven Weeks' War of 1866, for once they had served their purpose there was no demand for them. Some fifty or so lively action pictures taken by F. BRANDT are preserved at the Public Library, Kiel, showing scenes during the siege of the fortifications at Düppel, and after their capture by the Prussians in April 1864.

Franco-Prussian War and Paris Commune. Hundreds of photographs were taken during the Franco-Prussian War of 1870–71 and the ensuing insurrection in Paris. Lord Wharncliffe, the British Ambassador in Paris, formed a valuable collection of these and other documents, now in the Gernsheim Collection, but unfortunately not a single photograph bears the name of its author. The same applies to a number of albums of original photographs published soon afterwards: *Paris Incendié*, *Ruins of Paris*, *Ansichten vom Kriegsschauplatz 1870–71*. The only names of photographers known to us are those of DISDÉRI and LANGEROCK, the latter despite his name evidently working on the French side. Disdéri used a special photographic wagon for recording the ruins of St Cloud and Paris, and this van appears in at least one of his prints. The last of the above-mentioned albums depicts the war exclusively from the German side. The photograph of a wrecked German troop train and bridge near Mézières records a dramatic incident at the beginning of the invasion. Pl 150

The reign of terror during the brutal suppression of the Communard insurrection caused immeasurably more destruction and loss of life than the four months' siege by the Prussians. On 16 May 1871 Communards pulled down the Vendôme Column, to them a symbol of despotism, and sent the statue of Napoleon I tumbling. Recklessly they posed beside it for their photograph heedless of the possibility that the fortunes of politics might change. Indeed, those who were recognized were soon in peril of the firing squad, and Gustave Courbet went into exile. Other photographs show various public buildings such as the Hôtel de Ville, which went up in flames. Most gruesome of all are pictures of unidentified Communards laid out in their coffins. During Bloody Week, 21–28 May, 40,000 of them were killed in street fighting or by summary execution. Horrible documents of man's inhumanity to man!

Pl 151

Pl 152

The fact that these and numerous other early news photographs are so little known is due to the circumstance that until the general introduction of the half-tone block in newspapers in the early years of the twentieth century there was no means of reproducing them in the press, except by copying them as wood-engravings (see chapter 44).

23 *Landscape and architectural photography*

The popularity of the collodion process should not convey the impression that it had made photography easier. On the contrary, it had become more difficult, but the advantages of extremely delicate detail, improved half-tones and, in particular, increased sensitivity, compensated for the difficulty of manipulation.

The work of the professional portrait photographer was considerably eased by having at his command a much faster sensitive material, but the heavy additional burden the landscape photographer had to take about in equipment almost outweighed the advantages of the process. Most photographers still worked with folding wooden box-type cameras. The much lighter bellows camera, which would have seemed the ideal tourist camera, established itself only very gradually. Presumably the big bellows extension proved insufficiently rigid for the relatively long exposures (15–50 seconds) demanded by the large plate sizes which landscape and architectural photographers worked with: for, paradoxical as it may seem, the camera during the collodion period became both larger and smaller, according to the purpose for which it was intended. For stereoscopic and other fast exposure effects small cameras were of course essential, but for exhibition purposes, and for prints for sale, large pictures were in demand. With the realization of the possibilities of photography as an art medium–a development not considered to any great extent while photography was mainly in the hands of professionals whose object was to make a living out of portraiture–the lively competition stimulated by photographic exhibitions made pictures of imposing dimensions a *sine qua non*. As enlarging was not yet practicable, large pictures meant large plates from which to make contact copies: 10 in. × 12 in. and 12 in. × 16 in. were nothing out of the ordinary, and some handled plates of much larger dimensions. When a photographer asked the editor of *The Photographic News* for his advice as to the best size for a travelling camera, he replied, 'It should be capable of taking pictures 21 in. × 27 in.'[1] Some of FRANCIS FRITH's Egyptian and Palestinian views were taken on 16 in. × 20 in. plates, and E. BALDUS, the leading French architectural photographer, often employed negative material of similar size (40 cm. × 50 cm.). ROBERT MACPHERSON's Roman views go up to 16 in. × 20 in. and so do many of ROGER FENTON's landscapes and architectural studies of English cathedrals. At the Paris Universal Exhibition 1855 Baldus showed a landscape 1 m. 30 cm. (51 in.) wide, Bisson Frères a photograph of the Pavillon de l'Horloge of the Louvre 102 cm. × 77 cm. (40 in. × $30\frac{1}{4}$ in.) and Thompson & Bingham portraits taken on glass plates 80 cm. high ($31\frac{1}{2}$ in.). Some views of the Yosemite Valley by CARLETON E. WATKINS and C. L. Weed in the mid-1860s measure as much as 22 in. × 28 in., and WILLIAM HENRY JACKSON took a 20 in. × 24 in. camera to the Rocky Mountains in 1875.

Fig 40

Pl 150

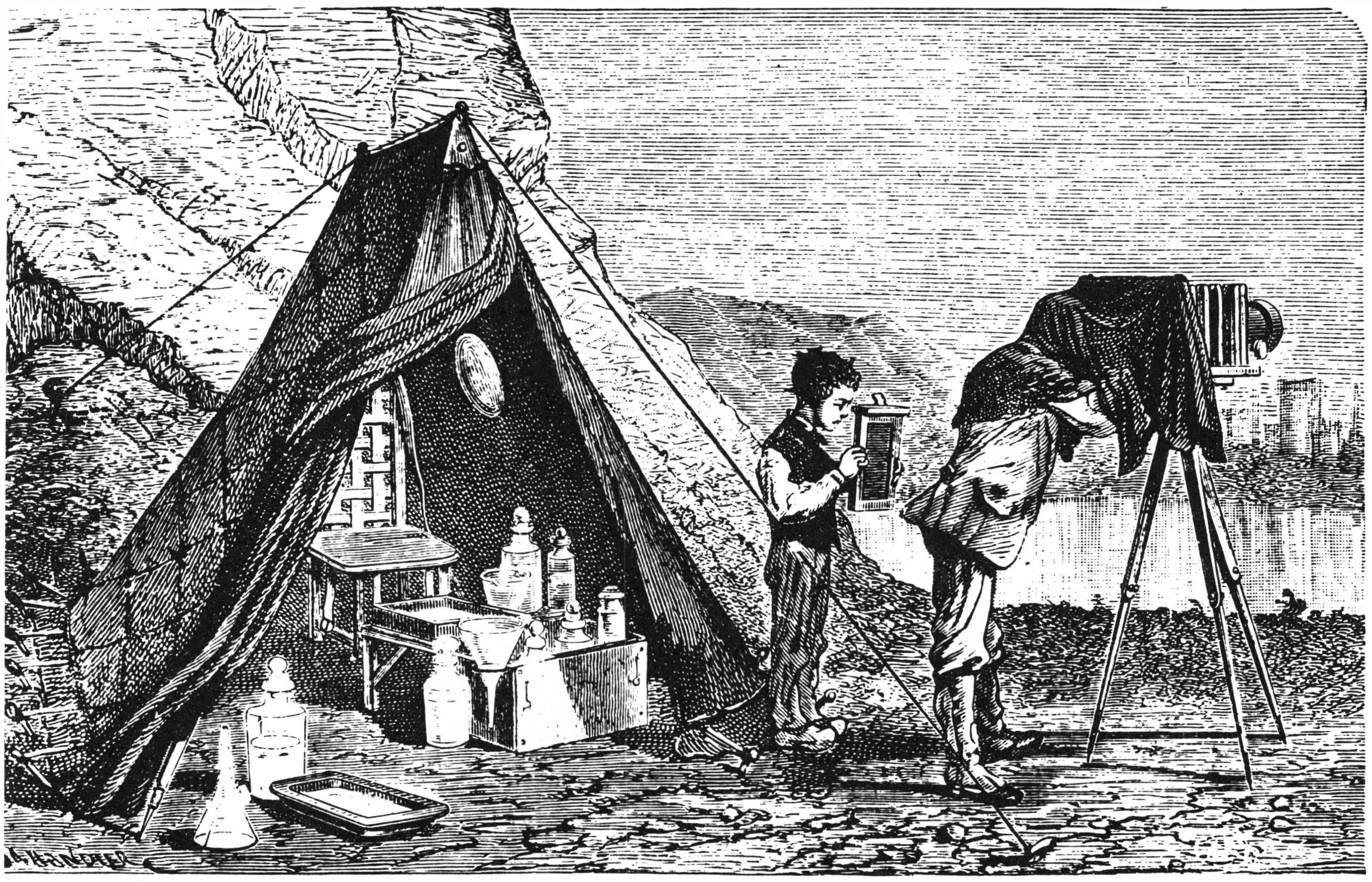


Fig 36 Travelling photographer's darkroom tent, c. 1865

Equipment of the photographic tourist

In addition to camera and a sturdy tripod, the photographic tourist was supplied with a choice of several lenses, a chest-full of chemicals or made-up solutions for coating, sensitizing, developing, and fixing the glass negatives; a number of dishes; a good supply of glass plates; scales and weights, glass measures, and funnels; a pail to fetch the rinsing water and, where none was likely to be met with, the water itself.

Above all, he needed a portable dark-tent in which all the chemical processes took place. Fig 36 Some tents were commodious, but more often than not the photographic tourist had to be content with a large yellow calico bag which he drew over his head and fastened tightly round his waist with an elastic band. The chemical manipulation Fig 38 was performed while standing at a folding table. These one-man tents packed conveniently into a box (weight 17 lb.) but were suffocating in use. Yet all this was cheerfully borne by 'The Pilgrims of the Sun'[2] in pursuit of the new vocation.

> How many a puny limb and flaccid muscle might become tough and brawny, how many a contracting chest and failing lung might experience for the first time the invigorating influence of the pure oxygenation which is only to be found 'over the hills and far away'? Nay, may we not even ask how many a purposeless life, by assuming this 'shadowed livery of the burnished sun' might thus find an object, and in its health-bestowing soul-expanding service realise the fact that 'life is earnest', and progressing always Excelsior, excelsior, go on to discover aims even higher and nobler than those which are to be found in the atelier of the sun.[3]

The bulk of the equipment needed can best be appreciated from the account of a Scottish photographer.

> I reached the railway station with a cab-load consisting of the following items: A 9″ × 11″ brass-bound camera weighing 21 lbs. A water-tight glass bath in

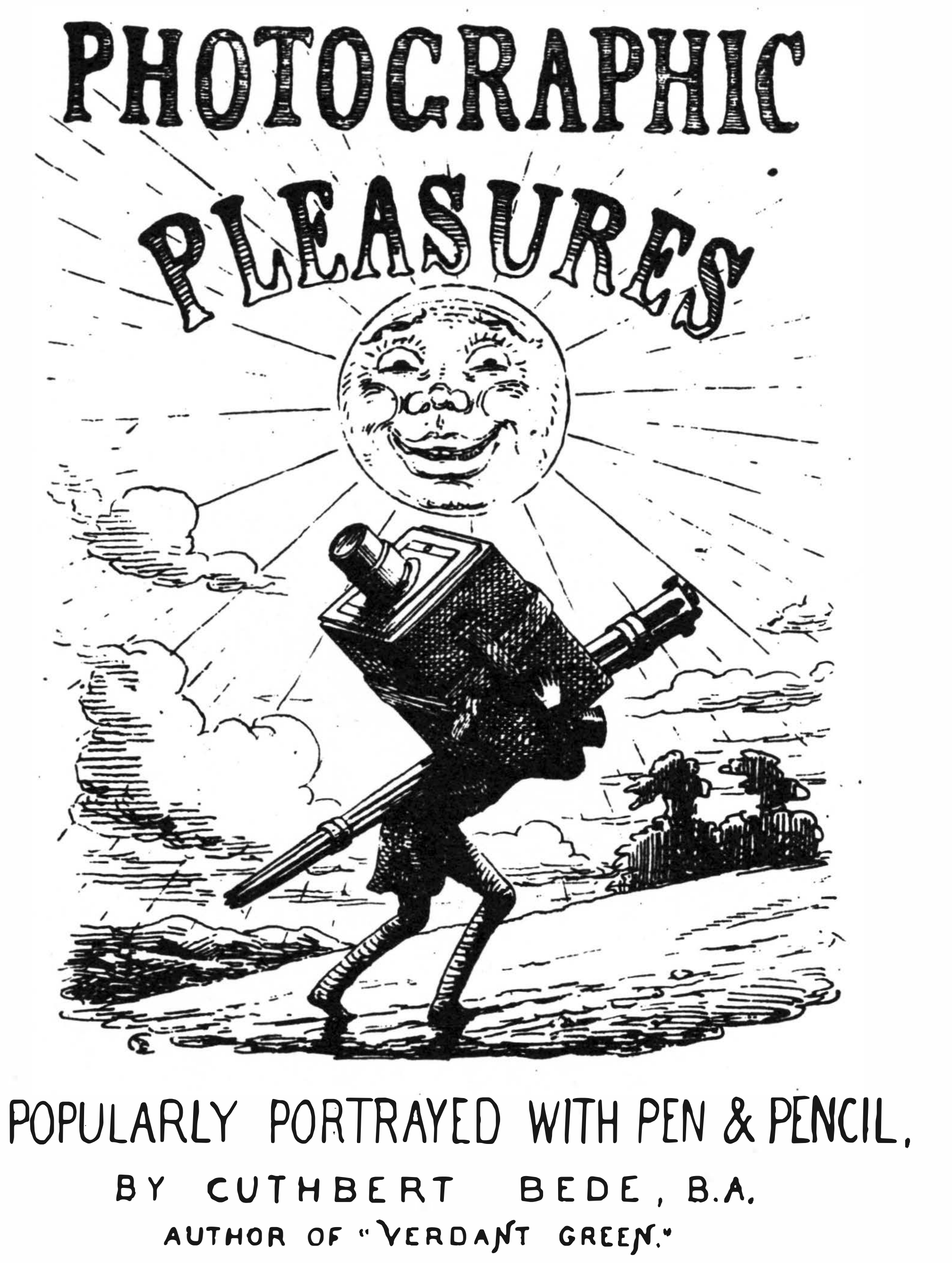

PHOTOGRAPHIC
PLEASURES
POPULARLY PORTRAYED WITH PEN & PENCIL.
BY CUTHBERT BEDE, B.A.
AUTHOR OF "VERDANT GREEN."

Fig 37 'Cuthbert Bede'. Caricature, 1855

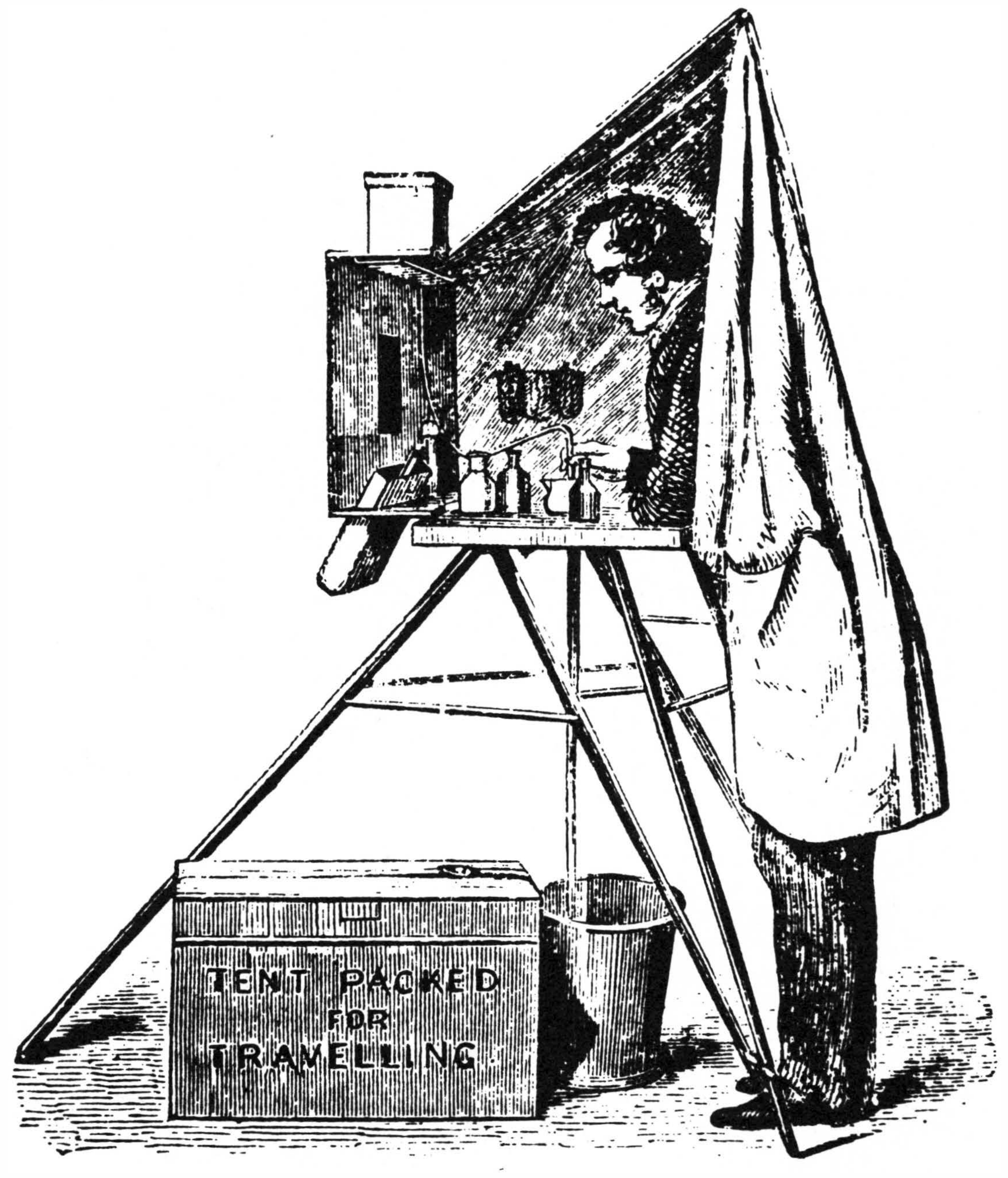


Fig 38 Edward's darkroom tent, 1862

> wooden case holding over 90 ozs. of solution [nitrate of silver] and weighing 12 lbs. A plate box with a dozen 9″ × 11″ plates weighing almost as many pounds. A box 24″ × 18″ × 12″ into which were packed lenses, chemicals, and all the hundred-and-one articles necessary for a hard day's work, and weighing something like 28 lbs. The advent of folding tripods had not come [*c.* 1857], at least, folding tripods that were rigid enough for such large cameras, and so I had perforce to encumber myself with one that when closed looked like an Alpine-stock over 5 ft. in length. It weighed about 5 lbs. Lastly, there was the tent, that made a most convenient darkroom, about 40″ × 40″ and 6½ ft. high, with ample table accommodation; the whole packed into a leather case and weighed over 40 lbs.
>
> I was soon joined by a dozen or so of others similarly equipped, although in some cases with heavier loads, and in due time we started for our destination some twelve or fifteen miles from the city. With a load of about 120 lbs., although shared by an unlucky friend who had been pressed into service and of course promised copies of all the pictures that should turn out well, we did not care to walk far, and of course, where the tents were set up, there or thereabout the whole work of the day had to be done.[4]

Those who thought it both ungentlemanly and uncomfortable to stagger along bent double beneath the weight of cumbersome apparatus engaged a porter, often no doubt on the principle stated by a 'kindhearted' photographer: 'After all, portability is only a question of degree. If you carry it yourself, it becomes heavy before you have gone half a mile, but if you hire a man to carry it for you, it may just as well be 10 lbs. heavier.'[5] Fig 37

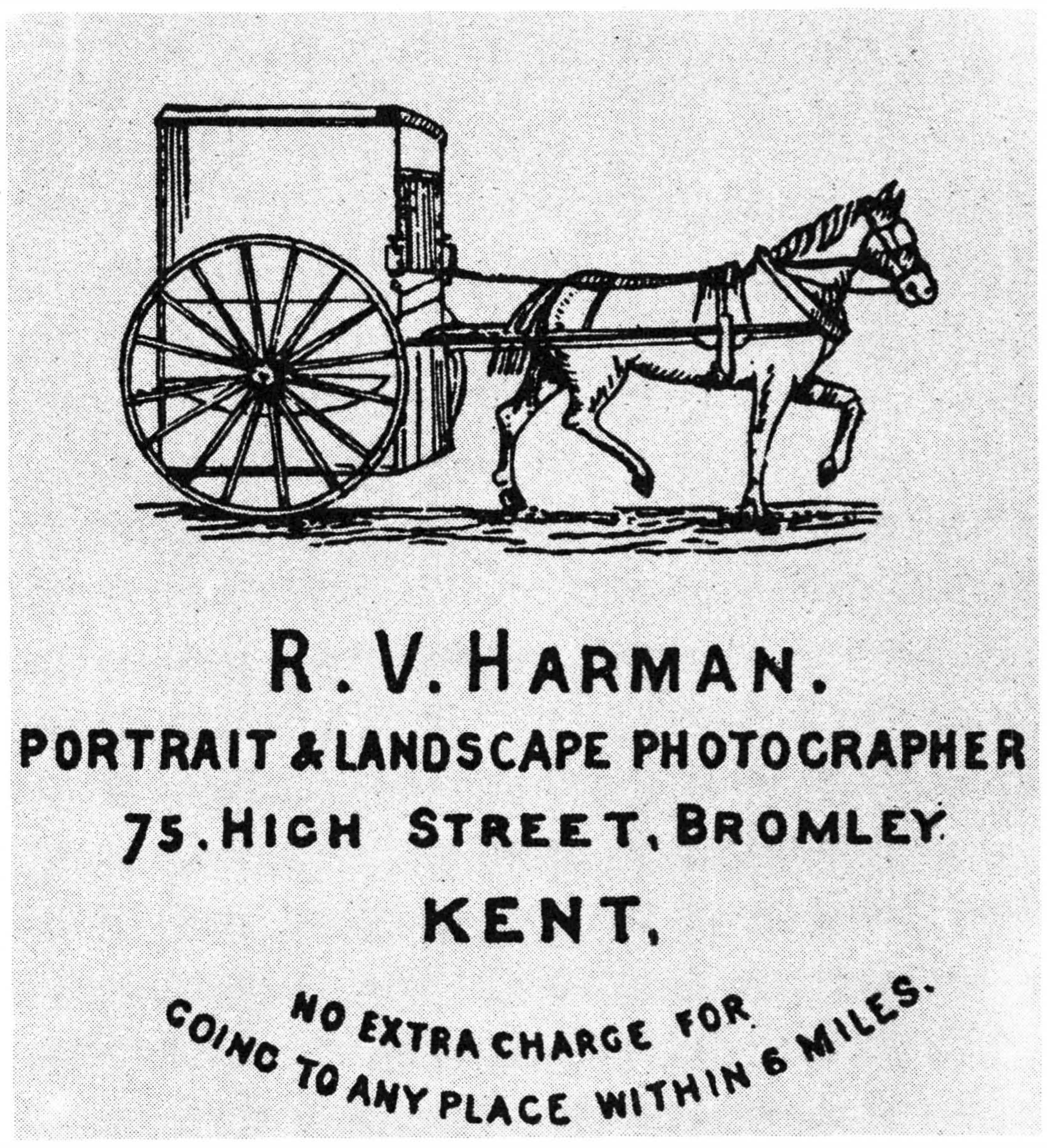
Others believed in doing the donkey-work themselves and pushed a wheelbarrow or small hand-cart containing all the equipment. Its mode of propulsion was at the option of the photographer. 'If a self-reliant and independent spirit, he would doubtless prefer "pushing his case" before him through the world; or if more inclined to indulge in *dolce far niente*, he can attach to the shafts a pony of Jerusalem, and slowly drive along through many a pleasant way of Merrie England.'[6]

The more successful, however, drove about from place to place in a carriage, for as one of them said, 'In these days of steam and progress everything that does not partake of the spirit of the age, or a locomotive tendency, is sure to be outdistanced by a faster rival.'

Fig 39

Sometimes the carriage simply served to convey the photographer and all his equipment to the scene; at others, it was completely fitted up as a travelling darkroom. Robert Cade even went a step farther, turning his fly into the camera itself by fitting the lens into the front window.[7] Such an arrangement had the advantage of avoiding the embarrassing crowd of gazing men, women, and children who frequently collected around a photographer–and children especially were a perfect nuisance to the photographic tourist. When they did not make fun of him, complained Cade, they were sure to upset his camera or chemicals, or poke their head into the tent just at the wrong moment.

> How many photographers could relate pleasing narratives of certain not over-pleasing incidents connected with their pictorial wanderings!–how, being mistaken for a pedler, they have been told, when about to plant their camera to take a view of some curious old farm-house or uninhabited ruin, that they need not unpack their traps, as there was 'nothing wanted';–how many times they have had to mourn over an upset bath of nitrate of silver, or a collodion bottle from which an ejected stopper has allowed all the precious fluid to escape;–how the perspiration has streamed from them as with lightning rapidity they popped in and out of the suffocating tent;–how some curious bull, anxious to know the contents of the suspicious-looking camera, has playfully employed his horns to lift it up for that purpose;–and how they have stood looking on in silent and pensive amazement, while a gust of wind has sent tent, bottles, and camera on a rolling expedition down the mountain's side. Such are a specimen of what every photographer may expect to meet with and undergo, in the ardent pursuit of his favourite study. Those, then, who imagine that photography is nothing more than a pleasant and idle pastime, are likely to find themselves greatly mistaken when they make a trial of it.[8]



R.V. HARMAN.
PORTRAIT & LANDSCAPE PHOTOGRAPHER
75, HIGH STREET, BROMLEY
KENT,
NO EXTRA CHARGE FOR GOING TO ANY PLACE WITHIN 6 MILES.

Fig 39 Back of a carte-de-visite

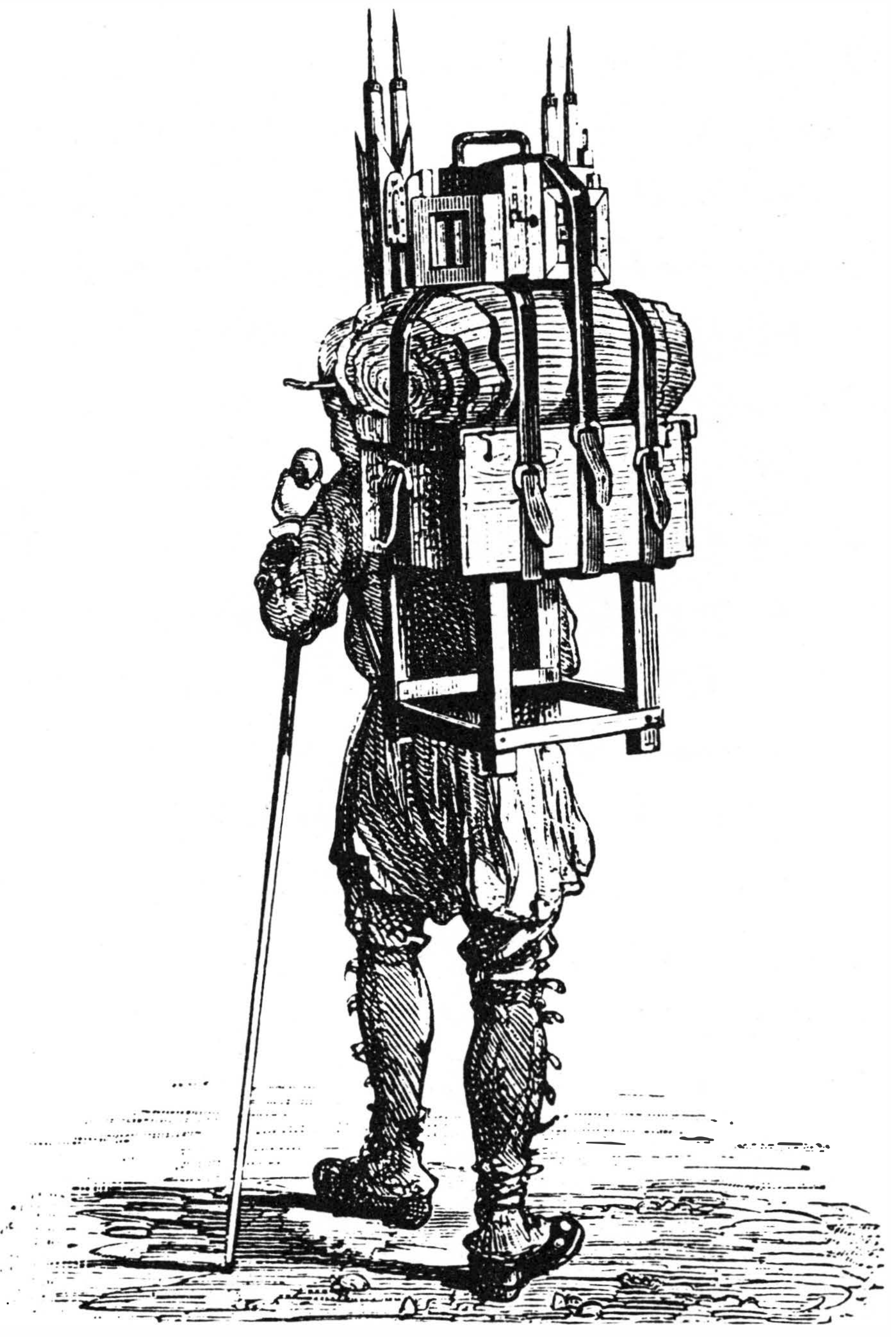


Fig 40 A photographic tourist of the wet collodion period

Photographers familiar only with the miniature camera can hardly imagine the herculean labours of the travelling photographer during the wet collodion period.

The great bulk of equipment was naturally a strong deterrent for all but the most determined amateurs, and many inventive minds worked towards a solution which would at least obviate the necessity for a portable tent. This could be effected either by chemical means–advance preparation of the plate and delayed development, which, however, decreased the sensitivity–or by constructing cameras fitted with a dark chamber in which all the chemical manipulation could be carried out. Such a camera, designed by SCOTT ARCHER for the talbotype process in 1849, was adapted by him for the collodion process, and throughout the evolution of photography it was modified numberless times to suit new processes. Archer's camera is the father of the cameras still sometimes used by street photographers today.

Attached to the camera's sides were loose sleeves of black material through which the operator introduced his hands into the body of the camera. At the back was a similar contrivance for the head, so that the photographer had in this camera all the advantages of a darkened room even when in the open country. Light was admitted through a small piece of yellow glass inserted in the top of the camera, which contained a glass or gutta-percha dish in which the various chemical operations were performed. During the exposure, the dish was dropped into a chamber at the bottom of the camera. Manipulating the chemicals *inside* the camera was, however, a messy business, even when exercizing the greatest care, and NEWTON's camera, introduced in 1852, overcame the most objectionable feature. The chamber underneath was divided into four compartments for the sensitizing bath, developing solution, fixing bath, and rinsing water, and the collodionized plate, attached to a rod, could be moved by rack and pinion and lowered into each compartment in turn.

Both Archer's and Newton's cameras were makeshift devices and failed to gain popularity. The serious amateur could not do without a tent. Arriving at last at his destination, he would naturally devote a good deal of thought to the choice of viewpoint *before* pitching it. There was no question of making quick exposures from different viewpoints and leaving the selection of the best until the darkroom stage, which is the accepted attitude today. On the contrary, the first exposure had to be right, and whether it was due to better art education of photographers in general or to the immense labour and expense photography entailed, the fact remains that those pictures which were taken were usually successful. Having regard to the time involved in unpacking and repacking the equipment, a tent might occasionally be pitched at a point which would serve as the centre for two or three views, but it was never safe to convey the sensitized plate a greater distance than about 3 minutes' walk. Progress was therefore slow and the man who could bring back as many as six pictures from a day's outing was lucky. Though he might have enjoyed a more congenial after-dinner occupation than a recourse to chemistry, his evening had to be filled with the bother and mess of preparations for the next day–preparations which, if they took place at an inn, sometimes figured conspicuously on the bill, no matter what precautions were taken to avoid stains.

EUROPE

Great Britain. Considering the brevity of his photographic career–only eleven years–ROGER FENTON was one of the most prolific as well as most versatile photographers. His English landscapes and cathedrals, and his series of art treasures taken for the Trustees of the British Museum in 1856–7 are as masterly in their different ways as most of his Crimean War pictures. 'Further than this the art of photography cannot possibly be carried, until either the means of producing the natural colours or processes absolutely instantaneous are discovered', was Thomas Sutton's opinion, adding, 'It is worth a journey from any part of Great Britain to the Metropolis, to see so superb a collection of artistic photographs.'[9] Apart from his views which were sold at printsellers and won many awards at international exhibitions, Fenton also illustrated a number of books, and was for some years chief photographer to *The Stereoscopic Magazine–A Gallery of Landscape, Scenery, Architecture, Antiquities and Natural History*, and to the Photogalvanographic Company, until his retirement from photography in 1862 to resume the legal profession.

The renown of PHILIP HENRY DELAMOTTE, professor of drawing at King's College, London, is chiefly based on his superb photographic documentation of the Crystal Palace. We owe to him some grand views (by the waxed-paper process) of the empty Crystal Palace building in Hyde Park after the close of the Great Exhibition, which are greatly superior to the talbotypes published in the *Reports of the Juries.* When it was decided to rebuild the Crystal Palace on a new site at Sydenham, Delamotte took every week some collodion photographs of the work in progress for the directors of the Crystal Palace Company, producing a thorough documentation from the levelling of the site to the opening ceremony by Queen Victoria. From these hundreds of photographs a selection of 160 was published in 1855 under the title *The Progress of the Crystal Palace, Sydenham.* Apart from this *magnum opus* Delamotte published numerous stereo views of the building and exhibits, and a portfolio of larger prints specially taken for the Crystal Palace Art Union in 1859.

HENRY WHITE, a London solicitor, was for about ten years from 1854 a prominent
Pl 153 amateur photographer, whose quiet pastoral idylls of cornfields and haystacks, and close-ups of ferns or bramble and ivy on a wall recalled to Ernest Lacan the poetic images of James Thomson's *The Seasons.* Similar close-up nature studies presaging the New Objectivity style of the 1920s were produced, rather surprisingly, at the
Pl 156 Military School of the Royal Engineers at Chatham (see page 231), where from 1856 onward photography was taught to officers and sergeants.

At this period occurred the establishment of several big photographic publishing firms: those of Joseph Cundall in London, Francis Frith in Reigate, James Valentine in Dundee, and George Washington Wilson in Aberdeen. They all started as individual photographers and later employed a large staff travelling round Britain and the Continent, eventually amassing a stock of tens of thousands of photographs of scenery and architecture.

In 1855 the REV. A. F. S. MARSHALL issued a pamphlet on *Photography: the Importance of its Application in Preserving Pictorial Records of the National Monuments of History and Art*, which is the first English publication to draw attention to this specialized field, which the French pioneered with their work for the Comité des Monuments Historiques four years earlier (see chapter 15).

Several organizations in London worked for the wider dissemination of historic architecture and antiquities. The exclusive Antiquarian Photographic Club, for which only Fellows of the Royal Society, of the Society of Antiquaries, and members of the Royal Institution, were eligible, was founded in 1854 for the purpose of making periodic excursions into the country to photograph subjects of historic interest. A copy of each photograph taken was deposited at the Society of Antiquaries.

The Architectural Photographic Association founded in May 1857 under the presidency of the distinguished architect Charles Robert Cockerell had as its aim the formation of a national collection of architectural photographs of important buildings in Britain and abroad. The photographic departments of the Board of Ordnance (Royal Engineers) and the East India Company, as well as a number of leading British and foreign photographers co-operated on the scheme by depositing photographs. Perhaps its programme was over-ambitious, for the Association was short-lived, being dissolved in October 1861. Re-constituted seven years later as the Architectural Photographic Society, its chief aim was the building up of a collection of photographs for architectural study. It was realized that to achieve this, most photographers needed the guidance of experts, and to avoid duplication careful planning was necessary. The Society chose the Rhineland for its first tour, which was organized almost on the lines of a military operation. 'Koblenz was fixed as the Headquarters of this very interesting expedition, round which the photographic excursions were to revolve. Most of the places on the banks of the Rhine from Cologne to Bingen were visited and explored by Mr Seddon, the accomplished architect, before the arrival of the photographers on the scene of their future operations. So were also the banks of the Lahn as far as Limburg and those of the Moselle as far as Münster-Maifeld, and thus when the whole working force had assembled, it was a comparatively easy matter to form the actual plan of action.' Such regimentation was hardly conducive to more than cold record work, and may be the reason why the account of the tour published the same year, 1868, under the title *Rambles in the Rhine Provinces*, was illustrated with only fourteen photographs, all by John P. Seddon himself.

Of the numerous mid-Victorian art-historical publications with excellent photographs only a few can be mentioned. In 1852–4 WILLIAM PUMPHREY of York issued sixty calotypes, 8 in. × 10 in., of *The Antiquities of York and its Environs* and a year later *Ruins of the Principal Monastic Houses of Yorkshire*. Naturally the picturesque ruins of English abbeys, and English cathedrals and castles, were favourite subjects for photographic essays. At the same period RUSSELL SEDGFIELD embarked upon his ambitious project *Photographic Delineations of the Scenery, Architecture, and Antiquities of Great Britain and Ireland*, which was issued in eight parts each containing six 8 in. × 10 in. views. Continental architecture was also the subject of many excellent English publications, e.g. *Normandy: Its Gothic Architecture and History* (1865) and *Flemish Relics, Architectural, Legendary and Pictorial, as connected with Public Buildings in Belgium* (1866), both by F. G. Stephens, contain brilliant photographs by **JOSEPH CUNDALL** and others. Indeed, the numerous photographic books that appeared during this period prove that there was hardly a picturesque scene or place of historic importance in Western Europe that had not been photographed. Some of these publications were inevitably expensive to produce, and are rare today on account of their very small editions.

Cheaper to issue and consequently enjoying greater popularity were books illustrated with stereographs, or more usually one-half of a stereo pair, 3 in. × 2⅞ in., like those in William and Mary Howitt's *Ruined Abbeys and Castles of Great Britain and Ireland* which came out in two volumes in 1862 and 1864, each illustrated with twenty-six photographs. Leading photographers–Roger Fenton, Francis Bedford, Thomas Ogle, Russell Sedgfield and G. W. Wilson–contributed to this book, but the effectiveness of their pictures is greatly diminished by the small format.

A valuable documentation was undertaken by the Society for Photographing the Relics of Old London, established in 1874 to record for posterity picturesque or historic buildings which had been condemned to destruction. Most of the photographs were taken by **HENRY DIXON**, others by **A. & J. BOOLE**, who did for London what **CHARLES MARVILLE** had done for Paris in Haussmann's time. When the labours of the Society came to an end in 1886, 124 carbon prints with accompanying historical notes by Dixon had been issued to subscribers. In the photographs London has the appearance of a charming old country town, with galleried inns, narrow streets, and small quaint houses with fascinating shop-fronts. Oxford Market, commemorated today in a narrow lane behind Peter Robinson's store in Oxford Street, was still a market in 1880. Thoroughfares like Fleet Street have since been altered out of all recognition or been demolished altogether. But thanks to this far-sighted society we know, for example, what the offices of the *Daily News* looked like, and Pl 154 the 'Oxford Arms', the fine galleried inn which stood in Warwick Lane, until it gave way to offices in 1878.

France. Baldus, Nègre, Marville and Le Gray, whose landscape and architectural photographs have already been discussed, continued their fine work for some years in the collodion period. Le Gray and Nègre retired in the early 1860s. The Bisson Pl 158 brothers, who were then leading in the field of architecture, withdrew from photography about 1865. It is their superb large views (15 in. × 18 in.) of historic buildings in France, Belgium and Italy, rather than their bread-and-butter work in portraiture and art reproduction, for which they are known today.

German-speaking Countries. The only photographer of distinction in this field during the collodion period to have emerged is **HERMANN KRONE**, a portraitist in Dresden. His topographical views of 'Saxon Switzerland' and towns in Saxony have been made much of in Germany but are of no more than average merit when compared with French, English and Italian photographs of similar subjects.

Italy. It has often been remarked that the area of Rome lying between the Piazza del Popolo and the Baths of Caracalla and between San Lorenzo and Monte Gianicolo contains more picturesque subjects than any other site of equal area in the world. Yet only a true artist can give these columns and arches the appearance of something better than historical relics; such an artist was **ROBERT MACPHERSON**, whose photographs are poetic descriptions, not mere transcriptions, of the classical scene. MacPherson emphasized in a striking way the mouldering grandeur of these Roman ruins, disdaining to descend to mere prettiness in their treatment, as did so many contemporary topographical artists. His photographs are full of atmosphere and show a most careful observation of the play of light and shade, the most essential feature in architectural and sculptural photographs, if they are to be infused with a life which they lack as subjects.

Orignially a surgeon in Edinburgh, Robert MacPherson had settled in Rome for health reasons in the early 1840s, where he exchanged the surgeon's scalpel for the painter's brush. He became a friend of artists and men of letters, including Thackeray, and a noted connoisseur of art whose services were indispensable to collectors. His knowledge led him to discover a number of valuable paintings, among them a Michelangelo now at the National Gallery, London. But painting and art dealing were in turn superseded by photography when in 1851 an old medical friend from Edinburgh visited Rome with his camera. The then new and fascinating art of photography at once attracted MacPherson, who perceived its value in a place so rich in art treasures as Rome; and just as his friend, who had little skill, was almost giving it up, he joined him in his photographic pursuits and speedily mastered the technical difficulties. His splendid views of the principal classical sites were soon in great demand by tourists. A hundred years ago Rome was a favourite winter resort of the English aristocracy – great collectors of art. Under Ruskin's influence, they paid scant attention to the palaces and churches of the Renaissance and Baroque periods, which in consequence figure less frequently in MacPherson's output than views of Republican and Imperial Rome. Within a year or two MacPherson gained Pl 159 the reputation of being the leading architectural photographer in Italy, a position difficult to maintain in face of the excellent work produced by JAMES ANDERSON in Rome, the brothers ALINARI in Florence, and CARLO PONTI in Venice.

MacPherson first worked with the albumen process, but in 1856 changed over to the somewhat quicker collodio-albumen, which still retained the advantage that the plates could be prepared beforehand and developed at home – a necessity for working at the Vatican, where no photographic darkroom work was allowed to be carried out. Here MacPherson photographed all the important sculptures – over three hundred of them – about which he published a guidebook in 1863. Exposures with 'dry' preserved collodion were very long, particularly as MacPherson worked with very large negative sizes, 12 in. × 16 in., 16 in. × 18 in., and even 18 in. × 22 in. 'For a distant landscape in good light', he wrote, '5 minutes is enough; for near objects, 10 to 20 minutes, and in some of the sculpture galleries where the light is deficient, two hours were often required, and in one or two cases even an exposure of two days was necessary to produce a good negative.'[10]

Though best known for his Roman views, MacPherson also occasionally went outside the city for his subjects. He photographed at Perugia and Assisi, but apart from Tivoli and the Falls of Terni, there are few landscapes in his opus. But whether Pl 157 he focused on the famous Cascatelle or on a group of cypress trees in the garden of the Villa d'Este, he always created pictures of surpassing beauty, which were not dependent exclusively on the beauty of the scenery.

Only a Philistine could complain of 'lack of mathematical precision' in MacPherson's photographs, but such Philistines existed in photographic circles in 1858 no less than today, *vide* the review in *The Photographic News*, December 1858. In contrast to this unwarranted criticism, *The Art Journal* wrote in terms of the highest praise: 'It has been left to photography to picture Rome in such detail as it is not the province of painting to attempt. . . . In the light and shade of these ruins there is a sentiment which, with the stern truth of the photograph, affects the mind more deeply than a qualified essay in painting.'[11]

MacPherson's only rival in Rome was JAMES ANDERSON. Born at Blencarn, Cumberland, Isaac Atkinson, a watercolour artist, settled in Rome in 1838 under the assumed name of James Anderson and created a flourishing tourist business in small models of antique sculpture. In 1849 he became interested in photography, and for some years worked for sculptors in Rome. When, however, MacPherson proved so Pl 162 successful with his Roman views and photographs of antique sculpture, Anderson entered the same field, adding in later years the reproduction of paintings–a branch which was developed by his eldest son Dominic, who was chiefly responsible for enlarging the small collection to its present extent (40,000 plates) and world fame, covering not only works of art in Italian museums, but also in foreign countries, particularly Spain and England. The firm which James Anderson founded flourished in Rome under the direction of his grandsons, until the early 1960s when the negatives and prints were acquired by Count Vittorio Cini and united with the large stocks of negatives by the Alinari brothers and Brogi in a huge art-historical archive in Florence.

LEOPOLDO ALINARI and his brother GIUSEPPE, originally craftsmen in *intarsia*, founded in Florence the firm Fratelli Alinari in 1854 with the initial backing of the printseller Luigi Bardi, who paid for their expensive photographic apparatus in return for sole rights in the sale of their prints for some time. Their brilliant early photographs of 1854–5, taken on albumenized glass plates, such as the cathedrals of Pl 160 Florence and Pisa, and Ghiberti's bronze doors of the Baptistry in Florence, bear Bardi's name alone stamped on the mounts, which understandably led us for some years to attribute them to him. The Alinari brothers also photographed in France and Austria, but are best known for depicting the architectural monuments of central Italy and their surveys of paintings and sculpture in the Uffizi and other Italian art galleries. The usual size of their prints is 12 in.× 16 in. but occasionally they used plates up to 130 cm.× 90 cm. (51 in.× $35\frac{1}{2}$ in.)–a size which was also used by James Anderson.

The firm founded by GIACOMO BROGI in Florence in the late 1850s was chiefly noted for its art reproductions, especially paintings. This was a field in which naturally the Italians were particularly active. Two other Florentines, CALDESI and MONTECCHI, established themselves as experts in this field in London, their earliest work being *Photographs of the Gems of the Art Treasures Exhibition, Manchester 1857*. The five volumes with fifty plates each were jointly published by the Manchester printseller Thomas Agnew and his London counterpart P. & D. Colnaghi in 1858–9.

About this time CARLO PONTI, a Venetian optical-instrument maker, became Pl 164 known for his magnificent views of Venice, Padua and Verona, publishing a series of albums under the title *Ricordo di Venezia*, each containing twenty $10\frac{1}{2}$ in. × 14 in. views, to which other Venetian photographers such as Antonio Perini, Giuseppe Coen, and later Naya, contributed. Gifted with an artistic eye for composition, Ponti Pl 163 depicted the grandeur of Venetian palaces and churches, and the charm of backwaters and picturesque corners. One of his finest pictures is a close-up of the Greek Pl 161 bronze horses on the Basilica di San Marco. After Venice was given up by Austria following her defeat in the Seven Weeks' War in 1866, Ponti, now an Italian subject, was appointed optician to King Victor Emmanuel II.

Unaware of Baldus's great unpublished survey of the Louvre, FERDINAND ONGANIA, a Venetian publisher, believed his monumental work on St Mark's Cathedral[12] to be the first photographic survey ever to be made of any building. In over 500 photographs (probably by the collodio-albumen process) printed in Heliotype on 425 plates, every noteworthy detail of the brilliant exterior and rich interior of St Mark's can be studied without neck-twisting or the aid of binoculars. The high quality of these printed plates makes them almost indistinguishable from original photographs.

Spain. **CHARLES CLIFFORD**, an English resident in Madrid since 1852, was another artist of unusual merit. Apart from being a portrait photographer–he was appointed Court photographer to Queen Isabella II–Clifford was an outstanding interpreter of Spanish architecture and scenery. His *Vistas del Capricho* (1856) contains fifty views of the fifteenth-century palace of the Dukes del Infantado at Guadalajara and their eighteenth-century summer residence Capricho with its pond and park. At the Paris Photographic Salon the same year critics were enthusiastic about the 400 pictures, 35 cm. × 45 cm. (13¾ in. × 17¾ in.), in Clifford's *Voyage en Espagne*. They depicted, some by the waxed-paper process and others by collodion, the decaying grandeur of Spanish palaces of the fourteenth to sixteenth century, the charming summer residences of the aristocracy, cathedrals and monuments, and above all scenery in and around the most important Spanish cities. Portraits of the inhabitants of various districts in their local costumes completed the series. An album of the same title had already been shown by Clifford at an exhibition of the London Photographic Society in April 1854, and a series was planned to be issued as a publication in London and Paris in 1863 with printed text. The project may have been abandoned owing to Clifford's death. At the Gothenburg Art Museum we have seen the best collection of Clifford's work: fifty-three photographs including sixteen of art objects in the so-called 'Treasure of the Dauphin', now in the Prado, Madrid. Pls 166, 167

Queen Victoria bought some of Clifford's Spanish pictures, and the Queen of Spain used to make presents of his albums. In 1861 she sent Clifford to England with the express purpose of taking a stately portrait of Queen Victoria. Instead of having one of her children on her lap, or being shown knitting or reading, the Queen was portrayed by Clifford in evening dress wearing a diamond coronet. Not only Queen Isabella but English critics too found this regal portrait, taken at Windsor Castle in November of that year, a welcome change from the numerous homely representations which Queen Victoria herself preferred. It was considered the most imposing portrait which had been taken of the sovereign, and she herself liked it so much that she had it copied as an oil painting.

THE NEAR EAST

FRANCIS FRITH was another leading landscape photographer in the collodion period, and probably the largest publisher of Continental and English views. His fame nowadays rests chiefly on the many publications which ensued from his three tours to Egypt, Nubia, Palestine, and Syria, for these exemplify his finest–and at the same time earliest–work.

Sailing for Egypt in September 1856 in a yacht propelled by superheated steam, Frith visited the monuments of antiquity from Cairo up to Abu Simbel where he photographed the wonderful temple of Rameses II, hewn in the solid rock. From his vivid accounts of the numerous problems which this tour raised, some idea can be formed of the skill, resource, and patience needed in working with collodion in the hot and dry climate, and the speed with which every stage of the manipulation had to be carried out while the collodion was still moist. Many views had to be taken three times, on stereoscopic, 8 in. × 10 in., and 16 in. × 20 in. plates–each time for a different publication. The difficulties were aggravated by the suffocating heat in the dark-tent, from which every ray of light and consequently every breath of air was necessarily excluded, resulting sometimes in temperatures of 120–130° F.[13] Sometimes the collodion actually boiled when poured on the glass plate, and Frith almost Pl 169 despaired of success. Seeking the coolness of rock tombs for coating and developing the plates proved an unsatisfactory expedient, for these places were full of dust which settled on the plates, causing numerous spots. Frith travelled in his photographic van which he had brought out with him from England: a wicker-work carriage which served both as darkroom and sleeping quarters.

> This carriage of mine, being entirely overspread with a loose cover of white sailcloth to protect it from the sun, was a most conspicuous and mysterious-looking vehicle, and excited amongst the Egyptian populace a vast amount of ingenious speculation as to its uses. The idea, however, which seemed the most reasonable, and therefore obtained the most, was that therein, with right laudable and jealous care, I transported from place to place–my harem! It was full of moon-faced beauties, my wives all!–and great was the respect and consideration which this view of the case procured for me.'[14]

After Frith's return to England in July 1857 Negretti & Zambra published one hundred stereoscopic views, and Agnew a selection of both the larger sizes. The public, who had been enabled by the paintings of David Roberts and Vivant Denon to gain some idea of what the great Egyptian monuments were like, were amazed by the revelations of photography which, *The Times* declared, 'carry us far beyond anything that is in the power of the most accomplished artist to transfer to his canvas'.

Encouraged by the excellent reception of these Egyptian photographs, Negretti & Zambra commissioned Frith to take another set of stereoscopic views in Palestine and Syria, believing that their historical and biblical interest would create a demand even greater than for the Egyptian series. So at the end of November 1857 Frith set out again, first to Cairo, whence he travelled in his photographic van via Mount Sinai to Palestine and Syria, taking pictures of Jerusalem, Bethlehem, Damascus, Baalbek, and many other famous places, returning to England in May of the following year. A selection of the best 8 in. × 10 in. negatives of both journeys were printed at Frith's establishment at Reigate, Surrey in an edition of 2,000[15] and published by James Virtue in parts with accompanying text by Frith. When subscribers' requirements had been fulfilled, the remainder were published in two volumes (in 1858–9) entitled *Egypt and Palestine photographed and described by Francis Frith.*

The demand for views of the Near East seemed insatiable, and despite the arduous journey and extreme discomforts, Frith set off once more with his three cameras in the summer of 1859. On this trip he went farther up the Nile than any photographer had been before, travelling beyond the Fifth Cataract, about 1,500 miles from the Nile Delta. A hundred years ago few travellers ventured beyond the Second Cataract, which could be reached by boat. The continuation of the journey to the most remote ancient remains, some 500 miles farther south, had to be made on dromedaries. Accompanied by his dragoman, cook, two guides, and a boy, Frith covered the distance in eighteen days, taking as little baggage as possible, apart from the photographic outfit.

On account of their extreme novelty, Frith was able to exploit his Near Eastern views to an extent which would be impossible today. The results of these three journeys appeared in no fewer than seven book publications, in addition to sets of stereoscopic and loose photographs. The finest of these books, *Egypt, Sinai and Palestine*, with text by Mr and Mrs Reginald Stuart Poole (*c.* 1860) is probably the largest photographically illustrated book ever published: the text pages measure 21 in. × 29 in., the photographs being 20 in. × 16 in. The most expensive was *The*

Queen's Bible (1862), a limited edition of 170 copies illustrated with Frith's photographs and published by subscription at 50 guineas.

Previously in the foreword to his *Egypt and Palestine photographed and described by Francis Frith* the author had announced his intention to present to the public from time to time his impressions of foreign lands, illustrated by photographic views, 'should my life be spared, and should the present undertaking prove successful'. As both conditions were fulfilled, Frith carried out the task he had set himself, and after his tours to the Near East, he covered much of Western Europe with his camera, and issued portfolios of photographs of Germany, Austria, Switzerland, Italy, Gibraltar, Spain, and Portugal, as well as numerous photographically illustrated topographical books. Pl 165 Frith also illustrated books by other authors, including Mr and Mrs S. C. Hall's *The Book of the Thames* (1867) and Longfellow's *Hyperion* (1865), recording by photography the scenes of the hero's journey up the Rhine to Switzerland and the Tyrol.

Though he was artistic, much of Frith's later work is rather straightforward topography, 'that which here demands homage being chiefly the inflexible severity of truth' as a reviewer remarked, and this is not surprising in view of his enormous output. Frith was probably aware of this himself, for he confessed to a weakness for rapid production in all he undertook, and in directing his criticism at other photographers, at the time when he was creating his best pictures, quite unwittingly wrote probably the most objective verdict on his own later photographs. In a paper on 'The Art of Photography'[16] he justly argues that

> The rapidity of production of which the merely mechanical process of photographic picture-making is capable, may easily become a source of great mischief. The student should bear in mind that what he has to aim at is not the production of a large number of *good* pictures, but if possible, of *one* that shall satisfy all the requirements of his judgment and taste. That one when produced will be, we need not say, of infinitely greater value to his feelings and reputation than a lane-full of merely good pictures.

Unfortunately Frith did not always live up to these ideals. The demands of successful business to produce and sell as much and as quickly as possible are antagonistic to creative work.

Frith's architectural views are perhaps more striking than his landscapes, but only a photographer knows and can appreciate the difficulty of getting a view satisfactorily into the camera. 'Very rarely indeed does a landscape arrange itself upon his focussing glass as well, as effectively, as he would arrange it *if he could*', wrote Frith. 'No man is so painfully conscious as he is that Nature's lights and shades are generally woefully patchy and ineffective compared with Turner's; and in short, that although his chemical knowledge be perfectly adequate and his manipulation faultless, it is a marvel, an accident, a chance in a thousand, when a picture turns out as *artistic* in every respect, as his cultivated taste could wish.'[17]

Frith's pictures of the Near East are superior artistically and technically to those of Maxime Du Camp (see chapter 15). The temples, tombs and pyramids of Egypt attracted numerous photographers and resulted in a mass of French and English publications, none equalling Frith's high standard, with the possible exception of the 150 whole-plate photographs taken by Sergeant J. MCDONALD which illustrate the three volumes of *The Ordnance Survey of the Peninsula of Sinai* (1869).

FRANCIS BEDFORD's views of English scenery and cathedrals were held in such high esteem that he was commanded by Queen Victoria to accompany the young Prince of Wales on his educational tour of the Near East in 1862. The royal party, which Pl 168 included Dean Stanley, frequently interrupted their progress to allow Bedford to take photographs, and the Prince daily inquired as to his results, and occasionally himself attempted to take a picture. Bedford was provided with a guard of fifty soldiers to keep him and his apparatus from harm, and his set of 172 views, 10 in. × 12 in., which the Prince allowed him to publish, include several of the royal party.

From Palestine the party went to Syria, Constantinople, and Athens, visiting also several of the Mediterranean islands; and if the majority of the pictures which Bedford brought back from this four months' tour are in the nature of topographical views, we must ascribe this to the harassing circumstances under which the photographer worked, and not to any lack of artistic skill on his part.

INDIA

SAMUEL BOURNE, a Nottingham man, settled in Simla in 1861 and became a partner of Shepherd in succession to Robertson. Within a few years he was recognized as the leading landscape photographer in India, whose astonishing exploits in the Himalayas are related on page 291. The quality of Bourne's work is equal to that of the best landscape photographers of the period; his silver prints show a perfect gradation of tone in exceedingly difficult subjects such as dazzling white marble temples, while his almost three-dimensional rendering of distance in mountain views could serve as an example to many present-day landscape photographers who often lose perspective by over-filtering.

Pl 170 Several long and arduous expeditions yielded hundreds of views which opened up an unknown world to the eyes of the European public. By a practical division of labour, the printing and commercial distribution of Bourne's views was left to Shepherd in Simla.

Contemporaneously with Bourne a number of amateurs, mostly army officers, were producing fine landscape and architectural pictures. CAPTAIN L. TRIPE, the Government photographer in Madras, published in 1858–9 four volumes of views in Madura, Trichinopoly, Tanjore, and of the Elliot marbles and other objects in the Madras museum, each containing seventy or more original photographs. Some were illustrated with stereographs, others with larger prints up to 10 in. × 15 in. While CAPTAIN ALLAN N. SCOTT depicted the scenery and architecture of Hyderabad and Secunderabad in 100 photographs in 1862, CAPTAIN MELVILLE CLARKE illustrated a journey *From Simla through Ladac and Cashmere* with thirty-seven photographs. PHILIP H. EGERTON, Deputy Commisioner of Kangra, in his *Journal of a Tour through Spiti to the Frontier of Chinese Thibet* (1864) illustrated with thirty-seven 8½ × 10½ in. photographs his arduous three months' journey in the summer of the previous year to investigate an alternative route for the shawl-wool trade, during which he took the first photographs of the Shigri Glacier, and the life of the natives of Spiti. Also in 1864 appeared CAPTAIN T. G. GLOVER's forty-two fine 8 in. × 10 in. pictures of the Ganges Canal and *The Rock-cut Temples of India* with 100 stereo photographs by MAJOR GILL and text by James Fergusson. COLONEL BIGGS depicted *The Architecture of Ahmedaba* [Ahmadabad], *Capital of Goozerat* in 147 photographs, with architectural notes by James Fergusson (1866). These are only a few of the numerous photographic publications that appeared in India.

THE FAR EAST

JOHN THOMSON spent ten years in the Far East and related his various explorations and adventures in several volumes: *The Antiquities of Gambodia* [Cambodia] (1867) containing sixteen 8 in. × 10 in. photographs, *Illustrations of China and Its People* (1873–4), a four-volume work with 200 photographs including, in addition to scenery, many pictures of street traders which foreshadow his documentation of London life a couple of years later. *The Straits of Malacca, Indo-China, and China: or Ten Years' Travels, Adventures and Residence Abroad* (1875) was unfortunately illustrated only with woodcuts from the author's photographs and sketches. In the autumn of 1878 Thomson undertook his last photographic journey, to depict the latest addition to the British Empire, and the following year published *Through Cyprus with a Camera* in two volumes with sixty photographs.

Felice Beato's work in China and Japan has already been mentioned in chapter 22.

AMERICA

Outstanding work was produced by the San Francisco photographer CARLETON E. WATKINS whose beautiful 16 in. × 21 in. views of the Yosemite Valley made a considerable stir at the Paris Universal Exhibition, 1867. Pl 171 In the same year EADWEARD MUYBRIDGE's photographic activity was first mentioned in connection with his large views in the same region, possibly undertaken for Watkins, from whom Muybridge learned photography and was in partnership with for a time. The following year his work on an official Government survey of the newly acquired State of Alaska led to his appointment as chief photographer to the U.S. Government. During the 1870s Muybridge travelled extensively for the Central & South Pacific Railroad and for the Pacific Mail Steamship Co., taking publicity photographs in Panama, Mexico and Guatemala, but he gave up landscape photography when he embarked on his investigation of animal locomotion for which he is chiefly remembered today (see chapter 34).

One of the pioneers of the American West was WILLIAM HENRY JACKSON who devoted much of his long life to depicting its scenic marvels. He began his photographic career in 1868 by touring around Omaha with his darkroom wagon photographing views and Indian villages. From 1870–7 he was photographer to eight Government geological surveys, and had a canyon and a lake named after him. Nine of Jackson's views of the Yellowstone region, handed to every member of the House of Representatives and the Senate, were instrumental in passing an Act of Congress in 1872 declaring this area the first National Park. In order to promote sales of his pictures Jackson founded the Jackson Photo Company in Denver, Colorado, in 1879, transferring his extensive stock of negatives in 1898 to the Detroit Publishing Co. of which he was a partner, and extended its topographical archives by acting for some years as its chief cameraman.

TIMOTHY H. O'SULLIVAN, one of the Civil War photographers, was another great pioneer of the West. He took part in a Government exploration of the 40th Parallel 1867–9, and in 1870 in an expedition to survey a possible ship canal across the Isthmus of Panama. On further Government geological surveys (1871–4) O'Sullivan made impressive pictures of the majestic scenery of the valley of the Colorado River, produced some of his best pictures in the Canyon de Chelly, Arizona, and recorded Pl 172 the pueblos and Indians of New Mexico. O'Sullivan's topographical work was published by the Government in the form of 10¾ in. × 7¾ in. prints and stereographs.

Lastly we should mention a fine publication by the artist William Bradford on *The Arctic Regions illustrated with Photographs taken on an Art Expedition to Greenland* (1873). Bradford took two Boston photographers, DUNMORE and CRITCHERSON with him on the voyage, and the book is illustrated with 140 of their excellent photographs.

MOUNTAIN PHOTOGRAPHY

After sketching a panorama of the Alps from the Bell Alp, **JOHN RUSKIN** came down to Zermatt, where 'the first sun portrait ever taken of the Matterhorn (and as far as I know of any Swiss mountain whatever) was taken by me in the year 1849.'[18] It was a daguerreotype. In the same district four years later **FRIEDRICH MARTENS** took high Alpine and glacier views on paper negatives, and exhibited a panorama of Mont Blanc from fourteen negatives at the Paris Universal Exhibition, 1855.

In 1860 the Bisson brothers found a new field of exciting subject matter in the Savoy Alps. Italy had ceded Savoy to France in return for her aid in the war against Austria (1859), and the following summer Napoleon III and the Empress Eugénie toured their new province. Their excursion to the Mer de Glace was commemorated by the Bissons in an album of twenty-four excellent photographs of jagged mountain peaks, masses of ice, crevasses and snowdrifts. They presented a copy of *Le Mont Blanc et ses Glaciers: Souvenir du Voyage de LL. Majestés l'Empereur et l'Impératrice* to the imperial couple and were rewarded by appointment as Photographers to the Emperor.

Having explained the quantity of equipment which encumbered the photographic tourist during the collodion period, it may be easier to envisage the formidable difficulties which **AUGUSTE BISSON** had to overcome in order to secure a handful of Pl 174 views during his ascent of Mont Blanc in July 1861. Any mountaineer readily appreciates the difficulty of even an unencumbered climb of the highest peak in Europe. Undaunted by failure the previous year, Bisson undertook another ascent, accompanied by a guide and twenty-five porters, who carried the photographic paraphernalia. So great was local enthusiasm for the expedition that a salute of cannon was fired when the intrepid photographer set off from Chamonix. At nine in the evening the party arrived at the Grands Mulets–the camping place beyond which Bisson had failed to proceed the previous summer on account of bad weather–signalling their arrival by a Bengal light, to which Chamonix responded with salvoes of small artillery. After a few hours' rest, the party resumed the ascent by lantern-light, but in the morning, when only one hour from the summit, they were driven back by a snowstorm to their point of departure, the Grands Mulets, which they reached only just in time before avalanches began to descend on all sides with terrific thunder. About midnight of the second night the weather cleared, and once more the party made the long and arduous climb, and this time reached the summit without hitch at 8 a.m. The people in Chamonix, who had been anxiously watching their progress through telescopes greeted their arrival with more salvoes. But it was not yet time to shout Victory, for the most difficult task remained–taking photographs at height of nearly 16,000 ft. When the tent was erected and fitted out, Bisson coated and sensitized the first plate, for which steady hands were required–a condition made difficult by the long climb and the intense cold. In order to rinse the plate, snow had to be melted by the feeble heat of oil lamps. The exhausted porters fell asleep one after another; only Bisson and the guide somehow managed to keep awake. After exposing three 8 in. × 10 in. plates, which seemed to take an eternity, the baggage was repacked and the long descent began. At the Grands Mulets Bisson once more had the equipment unpacked and took fresh views. Meanwhile Chamonix prepared for the reception of the party with a grand fête, illuminations, and fireworks. Everybody was overjoyed, and none more so than Auguste Bisson.[19]

Other early Alpine photographers include two English amateurs, **W. D. HOWARD** and **F. H. LLOYD**, whose album of twenty-four whole-plate *Photographs Among the Dolomite Mountains* was published in 1865. In the same year some excellent photographs were taken by **ERNEST EDWARDS** in the Bernese Oberland and a selection of twenty-eight served to illustrate a book by his companion H. B. George: *The Oberland and its Glaciers Explored and Illustrated with Ice-Axe and Camera* (1866). Lastly we should mention a published album of seventy-seven photographs by **WILLIAM ENGLAND** entitled *Panoramic Views of Switzerland, Savoy and* [Northern] *Italy*, which appeared about the same time. Pl 175

William England, **ADOLPHE BRAUN** and the **FERRIERS**, were all especially noted for their fine Alpine views for the stereoscope; the two former published paper prints and the latter glass transparencies. Braun also issued large panoramic views 9 in. × 18 in. Originally a designer of floral patterns for textiles, Adolphe Braun, of Dornach, Alsace, applied photography to his work by photographing flowers. He showed over four hundred such pictures at the Paris Universal Exhibition, 1855, and some at the Salon of 1859. He was active in many fields and equally brilliant in all of them, though perhaps less in portraiture, in which the fascinating Countess Castiglione, Napoleon III's mistress, figures most prominently. He was most renowned for his nearly life-size flower studies, grand Alpine views–which include some amusing pictures of crinolined ladies on glaciers–and still-lifes arranged with exquisite taste. Many of Braun's outdoor scenes are enlivened by elegant ladies and gentlemen, skilfully posed in the park of Versailles, at the Isola dei Pescatori, and elsewhere on Lago Maggiore. In these the picturesque scenery serves only as *staffage*. Lastly, Braun had a knack of capturing Parisian street life with all its bustling activity, such as a chocolate vendor in the Rue Castiglione–pictures admired as much over a hundred years ago for the photographer's skill as they are today as documents of a past epoch.[20] Pl 176 Pl 173 Pl 177 Pl 178

AIMÉ CIVIALE had different aims from selling views to the public. His goal was scientific: from 1859 onward for ten years he made a detailed record of the entire range of the Alps, which was eventually published in 41 panoramas: *Les Alpes au point de vue de la Géographie physique et de la Géologie. Voyages photographiques*, Paris, 1882.

Unimaginable difficulties in mountain photography were encountered by **SAMUEL BOURNE** in the Himalayas. Whereas the Alpine photographers were never more than two or three days from their headquarters, and could usually seek shelter in mountain huts at night, Bourne was often hundreds of miles from civilized centres for months at a time, and though his expeditions were organized and carried through with great determination and a certain ruthlessness, their success depended largely upon Bourne's resourcefulness in improvization, for, exploring regions in which no white man had set foot before, he was daily confronted with new problems.

The first trip to the Himalayas in 1863 lasted ten weeks, and produced 147 negatives. Thirty coolies carried the provisions and equipment, and the highest point the party reached was the Taree Pass, 15,282 ft.[21]

The following year Bourne undertook an expedition to Kashmir which lasted fully nine months.[22] This time twenty coolies were needed to carry the photographic equipment alone, which included two cameras, one for 12 in. × 10 in. plates, the other for 8 in. × $4\frac{1}{2}$ in., two lenses, 650 glass plates, a large quantity of chemicals, etc., and a particularly big dark-tent 10 ft square at the base and 10 ft high, to allow plenty of ventilation. Twenty-two more coolies carried Bourne's personal baggage, tents, bedding, camp furniture, cooking utensils, stores, brandy, sporting requisites, and books. There were in addition his staff of servants, and six dandy-bearers to carry him when he was tired of walking–'dandy' being the name of the conveyance. Sometimes two months passed before Bourne met another European, and the proximity of villages always brought difficulties, for the coolies, who had not at first realized what they were undertaking, had a way of abandoning their burdens on the road and seeking refuge in native huts. Bourne often had to search for them, and to force them under threat of punishment to continue. A serious mishap occurred when two coolies carrying a large case of (unused) glass plates slipped on a steep mountain path, badly injuring themselves and letting the case roll down a thousand feet, for this accident necessitated a month's journey to the nearest town where glass could be bought. The result of this tour was 500 negatives.

Another expedition, in 1868, took Bourne to the higher Himalayas.[23] Having this time sixty coolies, his main problem was the supply of fresh food. At a village called Mani at the foot of the Manirung Pass, the peasants used every possible argument to dissuade Bourne from crossing the pass, and to go by an easier route. The reason for their anxiety lay in the fact that Bourne insisted on hiring twenty extra men and buying additional food, for the pass was long and difficult. The village elders pleaded that they could spare neither men nor food, but Bourne remained unmoved, at last obtaining the men and supplies: bags of flour, a drove of sheep and goats, a yak for him to ride on, and three ponies for his servants. We can hardly imagine the extraordinary sight of that army of eighty men ascending the Manirung Pass, driving in front of them their live food supply. On the top of the pass, 18,600 ft up, Bourne managed to obtain three views before clouds came up. Until 1880 that was the greatest altitude at which photographs had been taken;[24] everybody suffered from headache, and the coolies lay down groaning and wanting to be left to die. Finding that persuasion was of no avail, Bourne had to use coercion to get his men on the march again.

The mountaineering part of this expedition was in itself a stupendous feat. Bourne relates that they had to descend a mile-long slope, almost a precipice; the next day they climbed 5 miles on a ledge so narrow that the intrepid explorer dared not look down. What the coolies, encumbered with heavy baggage, felt, is left to one's imagination. But the worst was still to come. Having pitched camp for two days and nights 14,000 ft up on a broad open glacier in snow and sleet and icy wind, Bourne discovered to his consternation that only one day's food remained, for the headman had disobediently bought only half the quantity ordered from the last village. Reckoning that they were three days from the next settlement, Bourne sent two men hurriedly in advance, while the main party continued at caravan speed. Eventually the men returned with food, but only after the coolies had been two days without any, and exhausted with hunger and cold, had become desperate. 'Had not relief come when it did', Bourne remarked drily, 'I do not know what might have been the consequence. They would probably have done for me, as the author of their misery.' Towards the end of the journey, the man carrying the nitrate of silver bath fell and broke it, and as Bourne lacked this chemical, the photographic activities came to an abrupt end. There was no alternative but to push on by the quickest route to the nearest civilized station, seven days' march distant. Sending a man ahead to order replacement by telegraph, Bourne obtained the chemical four days after reaching the town.

This description is necessarily shorn of many of the adventures with which Samuel Bourne enlivened his narratives, but we may at least have succeeded in conveying an impression of a truly unique achievement. 'I think photographic enthusiasm could not go much farther than this,' remarked Bourne.

24 The carte-de-visite period

The invention of the carte-de-visite—usually a full-length portrait 2¼ in. × 3½ in. mounted on a card 2½ in. × 4 in.—has been claimed by several photographers. DR HUGH W. DIAMOND, one of the earliest enthusiasts for photography in Britain, regarded himself as responsible for the introduction of the *carte*-size photograph in 1852, with an equestrian group presented to Queen Victoria.[1]

Ernest Lacan, editor of *La Lumière*, in October 1854 credited the idea to two prominent Parisian amateurs.

> E. Delessert and Count Aguado had an original idea for the use of small portraits. Up to now, visiting cards carried only the name, address, and sometimes the title of the person whom they represented. Why should not the name be replaced by a portrait? This idea met with great approval, since the special purpose of a visiting card could also be expressed by the *carte-de-visite* portrait. For formal calls, the visitor should be represented wearing gloves, the head bowed in greeting, as social etiquette requires; in bad weather he should be shown with an umbrella under his arm; for farewell visits, a portrait should be furnished in travelling costume.[2]

On 27 November 1854 ANDRÉ ADOLPHE DISDÉRI of Paris applied for a patent for carte-de-visite photographs, but the idea seems to have been thought of independently in many lands. *The Practical Mechanic's Journal* implied early in 1855 that the fashion arose in America.

> The Yankee man of fashion, it is said, does not descend to the prosaic plan of engraving his name on his visiting card, but fills his card-case with photographs of himself, which he hands instead. The idea is novel, but our means of recollection on this side of the Atlantic would hardly suffice to enable us to bring to mind the person and position of the visitor from a casual inspection of his picture.[3]

Sir David Brewster, on the other hand, stated that the *carte* portrait was originated in 1857 in Nice by the Duke of Parma, who had his portrait gummed on his visiting cards,[4] and according to Haydn's *Dictionary of Dates* (1868) *cartes* were introduced by the photographer FERRIER of Nice in 1857 for the nine-year-old Duke of Parma, whose example was soon followed in Paris, London, and Vienna.

As if the story were not already complicated enough, T. BULLOCK of Macclesfield also claimed the carte-de-visite as his invention in 1857. In an advertisement headed 'Another advance in Photography' Bullock announced 'a process by which he takes direct in the camera photographs on cards. . . . Address cards kept quite clean, and a splendid photograph on the reverse side.'[5]

After these many claims it may come as a surprise that the first suggestion of carte-de-visite portraits was made as early as 1851 by LOUIS DODERO, an enterprising Marseilles photographer. In his letter published in *La Lumière* on 24 August 1851 Dodero also suggested putting photographs on passports, hunting licences and similar official documents. In publishing Delessert's and Aguado's proposal three years later, Lacan had forgotten the original inventor.

Even though Disdéri was not in fact the inventor of the carte-de-visite, it was he who introduced and popularized it. Of humble birth and little education, Disdéri's verve and business acumen led to a meteoric rise in life from his first job as assistant in his father's draper's shop. About 1852 he left Brest, where he had a portrait studio, and after some months in Nîmes sought his fortune in the capital, keeping on his Brest studio. In the autumn of 1854 he opened in the Maison Robert Houdin at 8 Boulevard des Italiens a new portrait studio, the largest in Paris, financed, it was said, by an artist who had just inherited a fortune. It was not, however, for portraits but for *genre* and street views with traffic that Disdéri was first noted. In 1855 he formed a company which was granted the monopoly for photography at the Universal Exhibition in the Palais de l'Industrie.

Realizing that the usual charge of 50 to 100 francs (£2 to £4) for a single 8 in. × 10 in. print was too high for the general public and was the main reason why photographers found it difficult to make their expensive establishments pay, Disdéri, desiring to bring prices down, specialized for a while in Ambrotypes, which were then made by only one other Parisian firm of repute, Mayer & Pierson (apart from the cheap traders). Then, in November 1854, he hit upon a brilliant idea. In his patent he describes his method of taking ten photographs on one glass plate 'so that all the time and expense necessary to obtain one print from the negative are divided by ten, which reduces to very little the cost of each of these ten prints' (in practice eight was a more convenient number), and in addition because the sitter's head appeared so small retouching could be dispensed with. However, contrary to his expectation of being compensated a hundredfold for the smaller amount received from each client by the greatly increased number of sitters, the carte-de-visite did not establish itself for several years. Its popularity dates from May 1859 when Napoleon III, at the head of the army he was leading against Austria in support of Italy, halted the troops outside Disdéri's studio while he had his portrait taken. For Napoleon it was a brilliant stroke of personal publicity to make available to the masses cheap lifelike portraits of himself. For Disdéri and the carte-de-visite this incident was the beginning of real success. He found himself famous overnight. The whole of Paris followed the Emperor's example, and so great was the demand for *cartes* that appointments had to be booked weeks in advance. Disdéri was appointed Court Photographer. Pls 179, 181

To accommodate the great and mighty of the Second Empire in suitable style Disdéri's studio was sumptuously re-decorated during the early part of 1860, and was referred to as a 'Palace of Photography', outshining even Claudet's 'Temple of Photography' in London. The ceiling painting depicted the Apotheosis of Light, with Aurora, the sun chariot, etc. Medallion portraits of Porta, Niépce, Daguerre and Talbot decorated the walls of the reception hall, and in the corners stood allegorical statues representing Chemistry, Physics, Painting and Sculpture. What had formerly been reserved for the nobility, gentry and bourgeoisie now became accessible to the lower middle-class, who could afford photographs of themselves in the same elegant and luxurious surroundings.

Within a few years, Disdéri opened branch establishments in Toulon, Madrid, and London (August 1865), and the characteristic signature on the back of his *cartes* became a distinguished trade-mark throughout Europe. It is impossible to calculate the sums which passed through his hands: by 1861 he was reputed to be the richest photographer in the world, taking £48,000 a year[6] in his Paris establishment alone. This figure, at the price of 20 francs per dozen *cartes*, means that Disdéri's establishment had an average of 200 sitters every day. Assuming that each sitter ordered only a dozen copies, the daily output amounted to 2,400 prints, and the large staff of 90 dealing with this work were able to promise delivery within 48 hours. By February 1866 Disdéri was able to advertise a stock of 65,000 portraits of celebrities–a total presumably made up from all his studios. Whether they liked it or not, other photographers in Paris were obliged to follow the *carte* craze, and an army of new photographers exploited the boom. In the summer of 1861 it was stated that 33,000 people made their living from the production of photographs and photographic materials in Paris alone.[7] The same year the number of portrait studios in London had risen from sixty-six in 1855 to over two hundred; in 1866 when the carte-de-visite craze had reached its peak there were 284.

A typical *parvenu*, Disdéri spent his money as quickly as he made it; the luxury of his apartment, his several country houses, and expensive stables, were the talk of Paris. His fame was such that he was impersonated at a vaudeville theatre in 1861, with his bald head and large beard. But the good times did not last very long. By the end of 1866, the demand for carte-de-visite portraits was on the wane, and though Disdéri was quick to take up other novelties such as photographs on enamel, photographs on silk, 'natural photography without retouching', photo-painting, etc., he dissipated his fortune and finally was forced to sell his business, with his name, and ended as a beach photographer at Nice, where he died in the poor-house, deaf and half-blind. Pl 180

In England the carte-de-visite portrait had been introduced in 1857 by A. Marion & Co., a French firm of photographic dealers and publishers. These early *cartes*, which are very rare, have only a small portrait approx. $1\frac{1}{2}$ in. × $1\frac{5}{8}$ in. or $1\frac{5}{8}$ in. × $2\frac{1}{4}$ in., and no printed matter on the back–not even the photographer's name. The new style did not find favour in fashionable circles until J. E. MAYALL, one of the front rank portrait photographers, published in August 1860 his 'Royal Album' consisting of fourteen *carte* portraits of the royal family, which he had taken on 17 May and 1 July. Hundreds of thousands of these *cartes* were quickly sold, for everyone was eager to possess life-like representations of the universally loved Queen and her family. Their unparalleled success gave great impetus to this branch of photography through the understandable desire of every photographer to reap an equally rich harvest with *cartes* of other distinguished personalities, who in their turn were only too glad to follow the example set by the royal family, and to see their portraits for sale in shop windows alongside those of their sovereign.

The fashion for collecting *cartes* in albums, like stamps, began with Mayall's publication. The Hon. Eleanor Stanley, one of Queen Victoria's Ladies in Waiting, wrote on 24 November 1860: 'I have been writing to all the fine ladies in London for their and their husbands' photographs, for the Queen. I believe the Queen could be bought and sold for a photograph.'[8] Several of the Queen's diary entries show that she derived much pleasure from her 110 photograph albums. Some of the thirty-six royal carte-de-visite albums were arranged by the Prince Consort, as indicated by inscriptions in them. Photographs were exchanged with related royal families abroad, and others were obtained simply by asking for them, so that all European dynasties are represented in the royal collection–and indeed, almost everybody with a claim to distinction. A firm believer in the new art, Queen Victoria presented photographs on every possible occasion, and compiled lists as to who should receive them plain, coloured, framed, or unframed. Gladstone, for whom Queen Victoria had a barely veiled dislike, gave vent to his resentment on receiving what he called 'a twopenny-ha'penny scrap' on his retirement, whereas other Prime Ministers had been presented with the Queen's portrait in oils or bronze.

'Cartomania' was truly international. LUDWIG ANGERER, who introduced the carte-de-visite in Vienna in 1857, from 1859 on sold enormous quantities of *cartes* and
Pl 184 larger prints of the Imperial family; so did RABENDING & MONCKHOVEN. L HAASE
Pl 182 & CO. in Berlin could not print their *carte* portraits of the royal family and other Prussian celebrities quickly enough. The same can be said of SERGEJ L. LEWITKZY in St Petersburg and GEORG HANSEN in Copenhagen. In the United States during the Civil War the popularity of *cartes* was just as great as in Europe.

> Human vanity [wrote d'Audigier] is one of the most certain and profitable weaknesses of mankind. When the *carte-de-visite* portrait was invented, a goldmine was discovered. All those whose minds were empty and whose pockets were full, all young people and beautiful coquettes, who, after their own appearance, love nothing better than the image of it, were pleased that they could have their picture multiplied.

Public figures were constantly pestered for a sitting. In the trade they were termed 'sure cards', for each time a famous man consented to sit, several hundred pounds went into the photographer's pocket. Marion & Co. paid £400 per 10,000 copies sold, and the retail price was 1*s*. or 1*s*. 6*d*. according to the popularity of the sitter. Since tens of thousands of copies had to be on the market quickly in order to satisfy the great demand, and to crush all possible competition, a number of negatives were often required to print from.[9] It is reported that the London Stereoscopic Company, which added the profitable new line as the interest in stereoscopic photographs began to peter out, took no fewer than four dozen negatives of Lord Palmerston at one sitting.[10]

Some well-known people enjoyed sitting for their portrait; others avoided photographers. If Lord Brougham, who often sat, passed a shop window in which his photograph was exhibited he would inquire how it was selling. It was the best barometer of one's public image. Disraeli, on the other hand, was the most difficult public man to get for a sitting, and it was only at the express wish of the Queen, when Disraeli was staying at Balmoral or at Osborne, that he could be persuaded to have his portrait taken.

> The greatest testimony to your fame [wrote Mrs Carlyle to her husband] seems to me to be the fact that my photograph is stuck up in Macmichael's window. Did you ever hear anything so preposterous in your life? . . . It proves the interest, or curiosity, you excite; for being neither a 'distinguished authoress', nor a 'celebrated murderess', nor an actress, nor a 'Skittles' (the four classes of women promoted to the shop windows), it can only be as Mrs Carlyle that they offer me for sale.[11]

Though no callers had the bad taste actually to leave visiting cards bearing their portrait, which had been advocated by Edouard Delessert,[12] it became the custom to exchange *cartes* with one's friends, and even to beg strangers for theirs, thus fulfilling a forecast made by *Punch* in 1846. Speaking of the nuisance to which celebrities were subjected by autograph hunters, *Punch* wrote: 'We should not at all wonder that the next demand on a genius will be to send some unknown admirer "who hopes you will excuse the liberty" your photographic portrait.'[13]

Never was there a period in the history of photography when such large incomes were earned by able and enterprising professional photographers, though no one in England equalled Disdéri's receipts. Mayall outstripped other English professionals with £12,000 a year, his charge being 1 guinea for a dozen *cartes*. The output of his establishment alone is said to have exceeded half a million *cartes* a year, and Marion & Co., the largest photographic print-sellers in Britain, stated that they paid Mayall £35,000[14] in royalties for his photographs of the royal family in the course of a few years. Pl 183 A fair idea of the magnitude of these sales can be gauged from the fact that within a week of the death of Prince Albert no fewer than 70,000 cartes-de-visite of him (by various photographers) were ordered from this wholesaler. W. DOWNEY's portrait of the Princess of Wales carrying on her back her baby Princess Louise (1867) was the most popular ever issued by a photographer in Britain: 300,000 copies of it were sold.[15]

The best examples of the carte-de-visite style were those taken by CAMILLE DE SILVY, a French aristocrat and keen amateur photographer, who in 1859 exchanged his diplomatic career for the lucrative business of portrait photography. Silvy bought a large house in Porchester Terrace, Hyde Park, which he decorated and furnished in the most elegant Continental taste, with fifteenth-century Flemish tapestries, antiques, and *objets d'art*. Only one room–the Queen's room–was in English style; in its centre stood a silver equestrian statue of the Queen by Marochetti, which had cost £1,200. However, though Prince Albert came for a sitting, the Queen was probably the only English lady of rank who did not thus honour Silvy.

Gifted with impeccable taste and the Frenchman's intuitive understanding of women, Silvy published a series of *cartes* entitled 'The Beauties of England', Pls 186, 187 which earned him an international reputation, and a visit to his studio was *de rigueur* for persons of fame, wealth, or rank. Each Christmas they found their names printed in his *Golden Book* of clients, which read like pages from Debrett. Silvy may be called the Van Dyck of photography. Disdaining conventional studio properties he posed the sitters gracefully in his interiors, or against charming landscape backgrounds, which occasionally were painted specially to provide an appropriate individual setting: e.g. the Wellington monument for a portrait of the Duchess of Wellington, the dome of St Paul's for the Dean, a grand staircase for Princess Mary of Cambridge, a wild Scottish glen for Lady Airlie. An oriel window and a Gothic chair seemed the right setting for a bishop, and so did a library for an author. Silvy's income was never revealed but was sufficient to enable him to retire to his ancestral château in March 1869, when he sold his business, which had given employment to 40 men.

The most successful provincial photographer in England was Canadian-born OLIVER FRANÇOIS SARONY who settled in Scarborough in 1857. It was estimated that he made about £10,000 a year, following closely after Mayall. A broad flight of steps led up to the imposing entrance of his 120-ft long 'palace', furnished in Louis Quinze style–'the embodiment of good taste and costly elegance'. People came from many parts of the country to be photographed by Sarony, and as his business brought a good deal of money to the town, the town council renamed the square in which his establishment stood, 'Sarony Square'.

Oliver Sarony's younger brother Napoleon was also born in Quebec. He learned lithography in New York and studied painting in Paris. In 1864 at the age of 43 he came to England, received some instruction in photography from his brother, and soon opened a studio in Birmingham in collaboration with another French-Canadian professional, the renowned Silvester Laroche (see page 204). The venture, financed by Thrupp & Co., fine art dealers in Birmingham, prospered, but in September 1866 Napoleon Sarony left, and started a studio in New York. In the course of the next thirty years he rose to the unique position once held by Mathew Brady as America's best-known photographer. 'The Napoleon of Photography', as he was nicknamed, was an unconventional artist of greater powers than Brady, a born actor and story-teller, and by all accounts a delightful eccentric.

Even the smaller studios in Britain did a lively business in cartes-de-visite. J. R. SAWYER of Norwich took 6,000 negatives a year and sold 50,000 prints,[16] whilst HORATIO NELSON KING, who introduced the carte-de-visite into Bath, mentions an average sale of 60,000 to 70,000 *cartes* per annum.[17]

Well-known photographers usually charged 1 guinea for twelve *cartes*, and payment had to be made at the time of sitting. If two or more people were in the picture the price was usually half a guinea more per dozen for each additional figure, whereas until then it had been the usual practice to make no extra charge for a group of adults. In contrast to the impressive sums earned by a large number of photographers, their assistants, who worked from 8 a.m. to 6 p.m., received on the average £2 to £3 per week. The top wage for first-class studio operators was £250 a year.

Swamped with orders, photographers were inclined to serve Mammon rather than art. One operator boasted of taking ninety-seven negatives in 8 hours–just under 5 minutes apiece. In these conditions of mass production, is it to be wondered at if the poses are stereotyped? Few photographers had more than two 'sets' for posing, so, on the occasion just cited, forty-eight people must have been subjected to precisely the same treatment: that is to say, they were placed in the same position, in the same light, against the same fluted column or balustrade–and in all probability they had much the same expression.

Fig 41 His head fixed in a vice, the sitter was told to look at an indicated spot on the wall, and to keep quite still. Thus posed, he would regard the further operations with much the same feelings as he would those of a dentist; in fact in 1867 a modified form of Fig 42 dentist's chair was patented in which 'the sitter may lounge, loll, sit or stand in any of the attitudes easy to himself and familiar to his friends'. But in practice the sitter was usually adapted to the chair, not the chair to the sitter, and when he was least at ease, he was asked to look pleasant. There was no attempt at characterization, no endeavour to record what Julia Margaret Cameron called 'the greatness of the inner, as well as the features of the outer man'. What people wanted was a flattering picture, the flattery consisting now not in a retouched likeness, but in the photographer's arrangement of the pose and accessories.

Most studio properties were supplied by a few wholesale firms, such as Marion & Co., Seavey and Smedley, and this had the effect of depriving the portraits of their last vestige of individuality. To satisfy the taste of his clients the photographer would Pls 188, 189 call in the scene-painter, until at length the whole studio was transformed by make-believe, and the man behind the camera became more a stage-manager than a photographer. He could change the scenery as required, from an elegant drawing-room with classical pillars and a painted French window framing a view on to an Italianate terrace, to a country scene with a 'genuine' stile but painted trees, or a mountain with cardboard rocks and sham waterfalls.

Smedley & Co. of Blackburn had two favourite backgrounds, 'The Conservatory and Palm-house showing palatial entrance to Drawing-room, one end draped with curtain, opposite side Gothic window, clouded centre (i.e. where the figure comes) with fancy scroll overhead', and 'Lovely Seascape, showing rough sea and boats, with

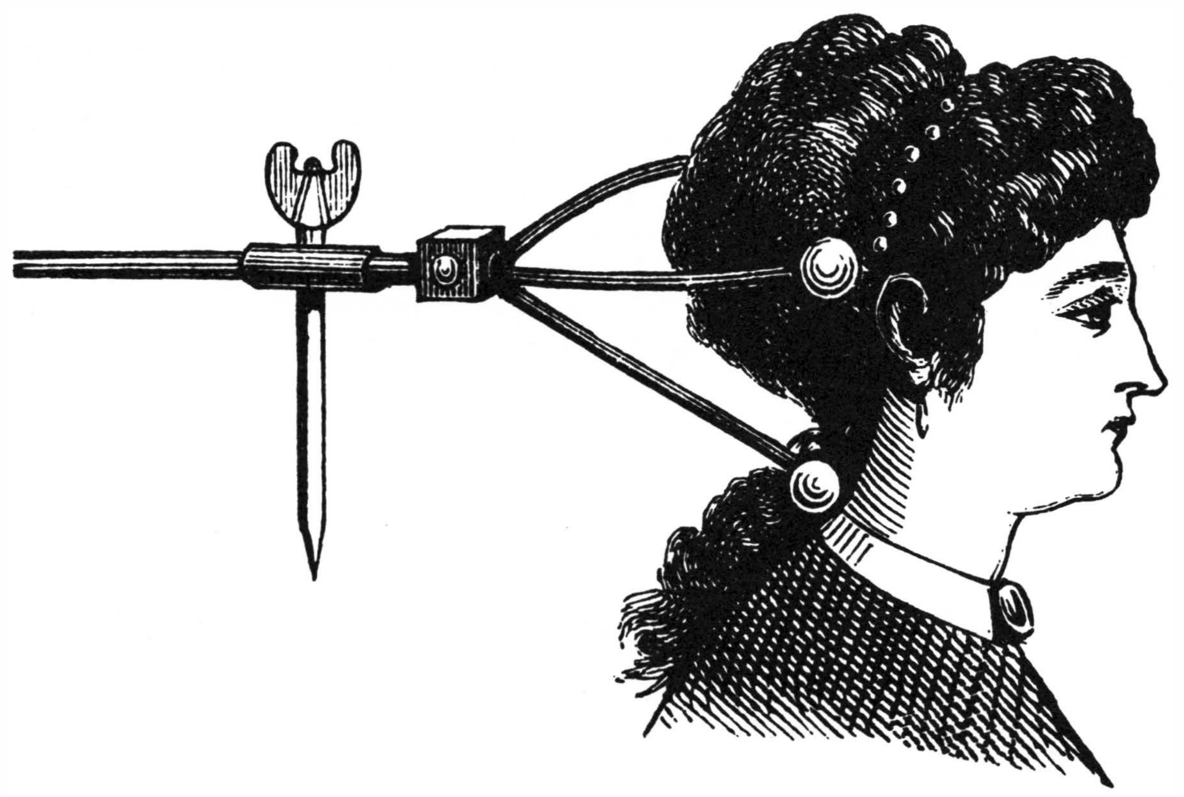


Fig 41 *Head-rest, c. 1868*

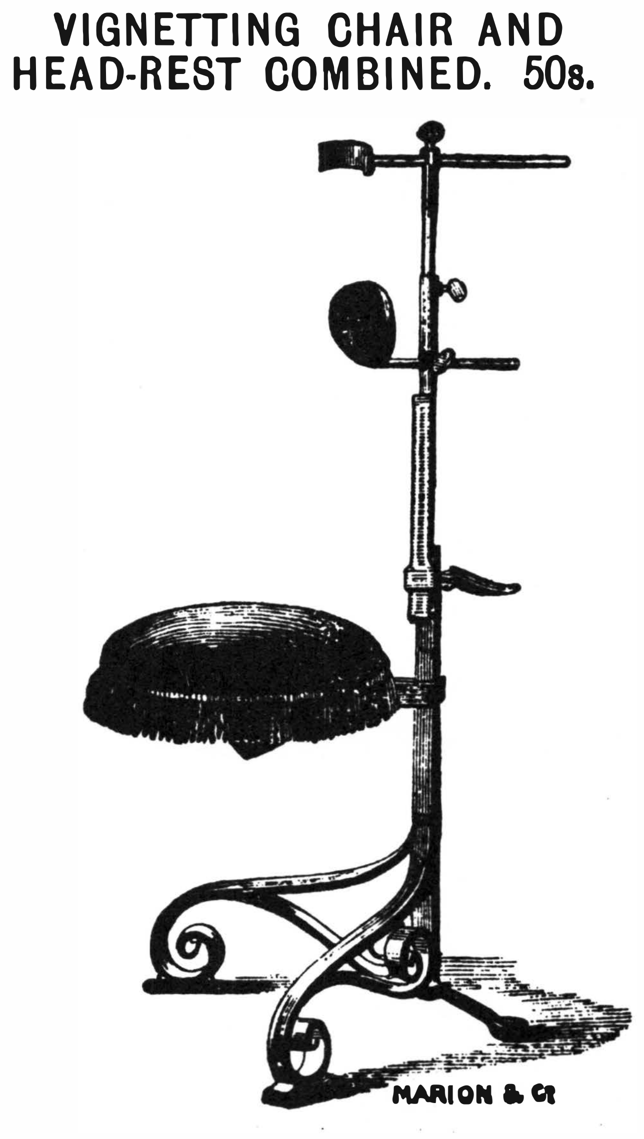


Fig 42 *Posing chair with head-rest, 1882*

rocks &c. in foreground'. But they offered to paint any design to order at the same prices as the above backgrounds, 15*s.* for one measuring 6 ft × 4 ft or 21*s.* for one 8 ft × 7 ft. Smedley also supplied a remarkable selection of chairs and settees, carved and upholstered, painted and inlaid, in hybrid styles which will one day puzzle antique dealers, for none have ever been seen or heard of outside photographic studios.

There was no limit to the fresh notions with which enterprising photographers sought to outdo their rivals, until they were themselves overtaken by some new craze. W. SAVAGE of Winchester advertised in 1869 that his establishment possessed 'every known appliance for the art'.

> In the noble glass saloon, groups of large numbers can at any time be taken, while the surrounding grounds are laid out entirely for photographing equestrian groups, cricketing groups, archery groups, croquet groups, and boating groups, with appropriate accessories. For the latter he has a large pool of water, on which is a beautiful pair-oared boat, backed by immense gnarled roots of trees, planted with ferns and their allies, which will form most interesting pictures.

Photographers who lacked a garden did not allow themselves to be inconvenienced, but introduced a boat into the studio. Marion & Co. supplied outdoor accessories of every description, such as a rustic bridge and hand-rail, and–particularly suitable for naval sitters–the deck of a steam-ship with wheel, funnel, bulwarks, etc. (the latter complete for a mere £7), or for soldiers, castellated ramparts with cannons. At ALEXANDER BASSANO's studio in Old Bond Street the client could choose a background from a large variety painted on a roll 80 ft long. This background cloth was mounted on rollers like a panorama, and the scenes varied from indoor to outdoor and through the seasons of the year. If the sitter chose a winter scene, chemical 'snow' was sprinkled over him. C. B. WALKER had for quicker changing effects various stage 'props' set up on a revolving platform in his Bayswater studio, London.

WILLIAM NOTMAN, a Scot who settled in Montreal, became noted for his studies of Canadian life taken in his studio. Sledge and hunting parties were so expertly arranged that the unwary are completely deceived. Trees, logs and rocks were brought into the studio, and tents, camp-fires, stuffed deer and bears so arranged that the trappers waiting for their kill seem genuinely on the trail. Salt made an excellent substitute for snow.

Each decade in the *carte* and later Cabinet period had its specially characteristic accessories. In the 1860s they were the balustrade, column and curtain; in the 1870s the rustic bridge and stile; in the 1880s the hammock, swing and railway-carriage (first-class, of course); in the 1890s palm trees, cockatoos and bicycles; and in the early twentieth century it was the motorcar, for snobs.

No Victorian drawing-room was complete without its photograph album. Political and religious associations, party and piety, found ample scope in the morocco-bound volume. The first few pages were usually devoted to the royal family. Then followed the public men who were admired, and lastly the family circle and friends. The album therefore served at once as an illustrated book of genealogy and a form of hero-worship. It was an excellent means of whiling away the awkward quarter of an hour before dinner, indicating to visitors the tastes and prejudices of their host: a portrait of Bishop Wilberforce or T. H. Huxley, of Charles Kingsley or of Cardinal Newman, of Disraeli or of John Bright, might guide the cautious safely through the hazards of small talk.

In the mid-1860s taste became more catholic, prompted by the caprice of fashion, and by the curiosity inherent in human nature about the appearance of celebrities of all kinds. Turning the leaves of the album, the visitor would find premiers and prima
Pl 185 donnas, preachers and pugilists, ambassadors and actors, and he would be reminded of the desirability of adding his own portrait.

Even the family Bible had spaces provided for *cartes*, and carte-de-visite albums were made to resemble prayer-books. When in due time the ordinary photograph album began to pall, the musical album provided a welcome touch of novelty: a musical box concealed in the album started to play its tunes when the book was opened.

What fascination there is in an old carte-de-visite album; how amusing to see the complacent expressions and the affected poses; to study the vagaries of fashion and the ingenious photographic legerdemain. Even the backs of some of the *cartes* are typical specimens of contemporary taste. To us, but not to our Victorian forebears, it is preposterous to see a lady in evening dress seated on a luxurious chair in a mountain pass, a cataract rushing within an inch or two of her immaculate gown–while in deference to her elegant shoes the mountain path is carefully carpeted.

Men apparently often posed leaning against Corinthian pillars, or sitting on them, with a heavy curtain concealing the stand of the head-rest; or precariously perched on a balustrade, walking-stick and top hat in hand, oblivious of the magnificent view behind them. But however incongruous some of the pictures may seem, all these accessories had been borrowed from painting, and in particular from Van Dyck and Sir Thomas Lawrence; with this difference, that often the photographer's *clientèle* looks awkward and out of place surrounded by such aristocratic accessories. The head-rest is of much earlier origin than one would expect. It was used by Sir Francis Chantrey, the sculptor, in the 1830s.

The fact was ignored that individuality is expressed as much by the figure as by the features, and that a portrait has much more character when the subject is in a position natural to him than when forced into one to which he is unaccustomed. Yet such was the trend of fashion that people were frequently represented in positions and in surroundings altogether unlike those in which their friends usually saw them. But a magnificent effect was exactly what people wanted; the humbler the home, the greater the desire for splendour, and the grander the studio, the more business a photographer could expect to do.

The *carte* pictures of women served as small fashion-plates to show off the sitter's latest dress and to do justice to the photographer's elegant interior decoration. As in all fashion-plates, head and body are only pegs on which to hang clothes. Facial expression is a secondary consideration since only a tiny representation of the head appears in the picture.

Depicted by the solar rays,
What loveliness this form displays!
The figure, what surpassing grace!
What radiant harmony the face!
Who such a likeness could have done?
No meaner artist than the Sun.

This portrait as it is will last;
And, when some twice ten years have passed
Will truly show you what you were;
How elegant, how fresh and fair.
I wonder what the mirror will,
Compared with it, exhibit still.[18]

Three hundred to four hundred million *cartes* were estimated to be sold annually in England at the height of the carte-de-visite period. So great, indeed, was the number that more than one Chancellor of the Exchequer contemplated following America's example and materially adding to the national income by a small tax on each photograph. Between September 1864 and August 1866 Americans had to affix a tax stamp to the back of all photographs, ranging in value from 2 to 5 cents according to the price of the photograph. Gladstone considered a penny tax in 1864, and so did Disraeli in 1868, when it was stated that a penny stamp on the roughly five million photographs sold annually would help in the prosecution of the Abyssinian war. This lower figure illustrates clearly the decline in the demand for *cartes*. Again, ten years later, Sir Stafford Northcote was advised that if he should find it necessary to increase the national income, he ought to impose a stamp duty on photographs. Such a tax, it was reasoned, was to a large extent one on vanity and snobbery, and for fiscal purposes these foibles were regarded as fair game. In each case, however, the idea was dropped quite possibly on the intervention of Queen Victoria, who on other occasions protested against the imposition of a tax on matches and one on beer, on the ground that taxing these simple necessities or pleasures would affect the poorest people most—and *carte* portraits were by that time the poor man's picture gallery.

The ingenious idea of passport photographs, first suggested by Louis Dodero in 1851, was now revived, and *Punch* suggested on 18 April 1863 that every traveller should have his carte-de-visite attested as his likeness before he started from home, and that the production of this portrait should open all frontiers to him. Nothing came of the idea for the time being, because most European countries were abolishing passports altogether. Identity photographs of this kind were first used in America by the Chicago & Milwaukee Railway Co. for season-ticket holders in 1861.[19]

Since the *carte* enjoyed such universal popularity, photographs of paintings, sculpture, architecture, and landscapes were issued in this format, and also collected in albums. It was the demand for these that ruined the sale for large prints and led to the retirement of the Bisson brothers, who were unwilling to reduce their grand subjects to insignificant little views. Gustave Le Gray and Roger Fenton, too, preferred to withdraw from photography altogether rather than lower their standards. *Carte*-size landscapes are the forerunners of picture postcards, for which the vogue began in Germany about 1884 (for landscapes), though in England they were not introduced until 1901 and represented celebrities–chiefly actresses.[20] The size was $3\frac{1}{2}$ in. × $2\frac{7}{8}$ in. or $5\frac{3}{8}$ in. × $1\frac{3}{4}$ in.

Among other *carte* novelties were 'mosaics', introduced in 1862. These combined many separate portraits on one print–for instance, the whole royal family, the British Association Meeting, 1862, or the Bishops of the Church of England. Disdéri, who patented the idea in France in April 1863, produced a *carte* containing no fewer than 320 'pinhead' portraits of famous contemporaries.

The 'Diamond Cameo' portrait registered by F. R. Window of London in 1864 shows four small medallions representing different views of the head, punched into convexity to give a semblance of relief.

An Irish linen firm in Paris, the Compagnie Irlandaise, introduced in 1865 *carte*-size portraits of their customers printed on handkerchiefs.

Carte-de-visite cameras. How were carte-de-visite pictures made? In his *Manual of Photographic Manipulation* (1858) LAKE PRICE described a stereoscopic camera with four lenses, with which two pairs of stereoscopic pictures could be taken, or, by means of a repeating back, four pairs. Two years later the London photographer C. JABEZ HUGHES adapted this camera for taking eight carte-de-visite portraits on one plate $10\frac{1}{2}$ in. × $8\frac{1}{2}$ in.,[21] exposing first one-half of the plate and then the other. The Pl 190 camera was fitted with four identical lenses of short focus ($4\frac{1}{2}$ in.), and the interior was divided into four compartments, one for each lens. If only one pose was required the photographer would make two exposures, each time opening all lenses at once. For a variety of poses, the lenses could be uncapped separately and a new pose taken each time. Indeed, several clients might be taken on one plate. The great advantage of this method was that eight pictures were obtained on one negative, and the resulting contact print could be cut by unskilled labour into the separate portraits, which were then mounted on cards. This camera did not come into use in France until 1861, after the Paris optician Hermagis had designed one for Mayer & Pierson in March 1860. It was not Disdéri's invention, as is sometimes erroneously stated; he originally worked with a single-lens camera based on Claudet's multiplicator.

Photographers who could not afford a four-lens camera adapted binocular cameras, with which two almost identical photographs were taken on one plate, or, used in conjunction with a repeating back, two pairs of negatives were obtained on a plate $7\frac{1}{4}$ in. × $4\frac{1}{2}$ in. It was Claudet's improved multiplying camera, shown at the Great Exhibition 1851, which first introduced the repeating back or multiplying action to the public. Fitted with a lens of short focal length (5 in.) and comparatively large aperture (3 in.), it was possible to obtain on one negative several small portraits, each representing the same person in a different pose, or a number of people grouped together. The several consecutive exposures were made by a sideways and downward movement of the dark-slide. The resulting pictures give rather the effect of a Pl 191 series of cinematographic 'cuts', as illustrated in a photograph by WILLIAM CARRICK, a Scottish miniature painter who, after working for Oliver Sarony in Scarborough, opened a studio in St Petersburg. Claudet's camera was adapted by the camera manufacturer Routledge of London, to take twelve *carte* portraits on one plate, with only one lens. In this case the plate was divided into twelve parts (three rows of four) which were brought successively in front of the lens by a sideways and downward movement of the dark-slide.[22]

Cabinet and other new formats. By 1867 the demand for *carte* portraits was rapidly waning, and it became necessary to find some substitute which would give new impetus to photography, which was going through a period of depression. This was done with more success than had at first been thought possible, by F. R. WINDOW, partner in the London portrait business Window & Bridge, who in a communication to *The Photographic News* of 18 May 1866 had suggested the Cabinet portrait,[23] larger and of better proportions than the *carte*. The Cabinet format was a portrait 5½ in. × 4 in. on a mount 6½ in. × 4¼ in. The idea was taken up readily by the editor of *The Photographic News*, who week after week urged photographers to bring the new picture size into fashion. Cabinet views had, however, originated four years earlier with G. W. Wilson, when the same editor praised the 'new style which will have many followers.'[24] Opticians made lenses for it, dealers produced albums for the new size, and slowly the Cabinet portrait gained ground in the leading London studios (after having been introduced with marked success in the provinces), the Continent, and America. By 1868 the Cabinet was universally adopted (though *cartes* continued to be made) and collecting began all over again.

During the late 1870s it became fashionable to have larger framed photographs hanging on the wall or standing on the piano. New formats appeared – the Promenade, 7½ in. × 3¾ in., the Boudoir, 8¼ in. × 5 in. (mount size), Imperial, 10 in. × 7 in. mount, the Panel, 13 in. × 8 in. mount, the last being introduced by Alexander Bassano.

For 1 guinea, the sitter could take his choice of 12 *cartes*, 6 Cabinets, or 4 Boudoirs. Leading portrait photographers could of course command much higher fees for framed pictures. VALENTINE BLANCHARD's charges were:

size in inches			
10 × 8	£2	10	0
12 × 10	£3	10	0
15 × 12	£5	5	0
20 × 16	£7	7	0
24 × 20	£8	8	0

Outside fashionable society, the *carte* and the Cabinet remained in favour, and mixed albums for both were popular until the First World War. Indeed, in the mid-1880s 'the growing distaste for Christmas cards has led to a greatly increased demand for *carte* or Cabinet portraits to take their place.'[25]

25 *Some famous portrait photographers*

Of the army of portrait photographers in the second half of the nineteenth century, many were excellent, though few deserve to be called 'great'. That the work of these few came as a revelation to critics and the public alike when in 1951 for the first time a large number of their portraits were shown at the Arts Council exhibition, 'Masterpieces of Victorian Photography', can be surmised from the *News Chronicle* statement: 'No convincing reason has yet been put forward why Victorian photographers made better pictures, especially portraits, than any of their successors have done with superior equipment.' The main reason undoubtedly lies in the fact that all the well-known Victorian photographers were formerly artists, or had at least received an art training. A contributory factor often overlooked is that fine portraits can only be taken by photographers who are either financially independent, or so famous that they can go their own way, for very few sitters will accept a realistic, truthful portrait, and only the man who photographs primarily for his own pleasure can afford to take portraits of people as they really are and not as they would like to appear. There are such photographers today, too, but their work is mostly lost in the sea of mediocrity. The vast majority of photographers are businessmen and nothing more; few have the good fortune to take only Men of Mark.

THOMAS ANNAN, originally a copperplate engraver in Glasgow, took up photography in 1855, specializing in landscapes and art reproductions, with which he achieved a reputation which extended far beyond the borders of his native Scotland. Pl 192 His fine portraits of Livingstone, the professors at Glasgow University, and other well-known contemporaries, were not taken in the ordinary course of business, but for publication. They are simple and straightforward, and characterized by complete absence of the usual studio 'props' and stereotyped poses evident in most professional work of the time. The portraits of professors, especially, show the influence of his friend D. O. Hill.

Among the few really great portraitists it is not a professional but an amateur who Pl 193 takes the leading place—JULIA MARGARET CAMERON. Born in Calcutta, Mrs Cameron was the wife of Charles Hay Cameron, a distinguished jurist and one of the members of the Supreme Council of India. Intellectual, artistic, and unconventional to the degree of eccentricity, the mother of six children of her own and several adopted ones, Mrs Cameron still had energy to spare for social, humanitarian, and literary activities. When, in 1848, the Camerons settled in England, their house soon became the meeting-place of men of letters and of art.

Photography came to Mrs Cameron by chance when her daughter presented her with a photographic outfit in 1863. Characteristically, she threw herself into this new occupation with enthusiasm and ambition. To master the difficulties of the collodion process was in itself no mean feat, and the courage with which these technicalities were tackled by a lady who never previously had to dirty her hands, commands admiration. But photography was far more to Mrs Cameron than a pastime; at last, at the age of forty-eight, she felt she had found her true purpose in life. Here was a means by which she could create beauty like her many artist friends; and for her, photography became a 'divine art'. The coal-house was converted into a darkroom, and the glazed chicken-house became her studio. Here she worked ceaselessly as long as daylight lasted, undaunted by failures and never sparing herself or her sitters–chiefly her maids–until in January 1864 she could triumphantly write under a photograph, 'My First Success'.

Self-taught, Mrs Cameron had perhaps too little regard for technical perfection, but her artistic conception was far above that of most contemporary professional photographers. Revolting against the characterless portrait-manufacturing of the carte-de-visite, Mrs Cameron strove to express the personality of her sitters. Working for her own satisfaction and not for money, she could afford to go her own way, and thus she became quite involuntarily a pioneer in a new kind of portraiture–the close-up. In this she was influenced by DAVID WILKIE WYNFIELD, a painter and amateur photographer, whose bust portraits of well-known artists Mrs Cameron admired. Though she soon developed her own style and so far surpassed her model that only a superficial resemblance exists between their work, she generously acknowledged Wynfield's artistic influence, at a time when her portraits were already much discussed. 'To his beautiful photography I owe *all* my attempts and indeed consequently all my successes.'[1] Whilst Wynfield's artistic outlook found expression in costume portraits, Mrs Cameron's large head studies (usually about 11 in.× 14 in.) did not need elaboration by meaningless accessories, and the intellectual force of her sitters stands out so much the stronger. Pl 194

Some of Mrs Cameron's technical difficulties were no doubt due to working with very large plates, which, coupled with her insistence on taking close-ups, necessitated a veritable howitzer of a lens, with a focal length of 30 in. This in turn required very long exposures even at full aperture, though the 7 minutes complained of by one sitter may not have been the general rule. But even if we assume the average exposure to have been 5 minutes, it was a very long time to sit still without the aid of a head-rest, which Mrs Cameron despised as not conducive to a natural pose. Consequently the risk of wobbling on the part of the 'victim' was great, and sitting to Mrs Cameron was something of an ordeal, dreaded by her husband and friends alike, for she would not let anyone out of her clutches until she had secured what she considered a good negative. Concerning a portrait of Wilfrid Ward, Mrs Cameron wrote to a friend, 'I counted four hundred and five hundred and got one good picture. Poor Wilfrid said it was *torture* to sit so long, that he was a martyr! I bid him be still and be thankful. I said, I am the martyr! Just try the taking instead of the sitting!' A close friend and neighbour of Tennyson at Freshwater, Isle of Wight, and on equally intimate terms with the painter G. F. Watts, Mrs Cameron had many opportunities of meeting the eminent during the twelve years of her photographic activity in England, and they were pressed into her service, sometimes by persuasion, sometimes worn into submission. When Tennyson brought Longfellow to her for a sitting he warned him, 'Longfellow, you will have to do whatever she tells you. I shall return soon and see what is left of you.'

In order to cut down exposures to a minimum, most professional portrait photographers let the light stream into their glasshouse from all sides, and this diffusion of light accounts for the flatness of the majority of their pictures. Mrs Cameron, on the other hand, cared little about the length of the exposure or the sitter's comfort, and cut down the light, directing it to model the features and emphasize the characteristics of the sitter. She adopted what has since become known as the 'Rembrandt effect', but she never let her posing or lighting become a mannerism. On the contrary, she experimented ceaselessly and treated each of her sitters individually. In this versatility and continual striving for character she shows a mastery that makes her work stand far above that of other contemporary photographers, and at exhibitions her photographs always aroused vehement discussion. Such work had never been seen before. Photographers on the whole did not take kindly to it, but some of the most famous artists and writers of the day were so encouraging in their praise that Mrs Cameron felt as if she 'had wings to fly with'. What finer tribute could anyone hope for than that the leading portrait painter in Britain, G. F. Watts, should inscribe one of her portraits, 'I wish I could paint such a picture as this',[2] and in 1866 he wrote in a letter: 'Her work will satisfy posterity that there lived in 1866 an artist as great as Venice knew'.[3] Victor Hugo wrote, 'How can I thank you enough, Madame, for this new kindness [a gift of photographs]? You overwhelm me. All of them are beautiful; not one of the photographs but is in itself a *chef-d'œuvre*. No-one has ever captured the rays of the sun and used them as you have. I throw myself at your feet.'

Mrs Cameron's portraits of her illustrious contemporaries–Tennyson, Browning, Pls 195, 196 Longfellow, Carlyle, Trollope, Taylor, Herschel, Darwin, Ellen Terry, and many others–have won a lasting place in the history of an era because they are the works of a great personality–the most vigorous and expressive documents we have of the great Victorians. In Roger Fry's opinion, her portraits 'bid fair to outlive most of the works of the artists who were her contemporaries'. The distinguishing feature of Mrs Cameron's work is that she had the real artist's faculty of piercing through the outward structure to the soul of the individual: 'When I have such men before my camera', she wrote of Carlyle and Herschel, 'my whole soul has endeavoured to do its duty towards them, in recording faithfully the greatness of the inner, as well as the features of the outer man.'

Only two French photographers, Nadar and Carjat, came close to Mrs Cameron's achievement, but neither quite attains the power of her work.

Pl 198 GASPARD FÉLIX TOURNACHON, called NADAR, was thirty-two when he started on his photographic career. A struggling journalist and caricaturist moving in the bohemian circle of Henri Murger, he was persuaded by the writer Chavette to take up photography as a more secure living than the ups and downs of freelancing for *Le Charivari*, *Le Journal pour Rire* and other humorous papers. Nadar learned the collodion process and in 1853 associated himself with his brother Adrien for a few years in the latter's studio at 113 Rue Saint-Lazare, Paris. Two years later the portraits of Tournachon et Cie. received high praise at the Universal Exhibition in Paris.

The caricaturist's ability quickly to grasp the essential characteristics of the sitter proved a valuable asset in obtaining forceful portraits, and most of them bear the unmistakable stamp of his own strong personality. Following the straightforward approach of the daguerreotypists, Nadar's portraits taken against a plain dark background are outstanding for their simplicity and directness. When possible, he preferred full sunlight; occasionally he achieved dramatic effects by side-lighting, a Pl 197 novelty at the time.

In addition to his new career as a photographer, Félix Tournachon continued writing short stories and making caricatures for the press. As early as 1842 his talent for stinging caricature had earned him the nickname 'Tourne à dard' (dard=sting).

'Tournadard' he shortened to 'Nadard' and later to 'Nadar', the nom-de-plume with which he signed his short stories, articles, caricatures, books and photographs, and which eventually came to be regarded as his surname.

In 1854 a big sheet of 270 lithographed caricatures of celebrities appeared under the title *Le Panthéon Nadar*. In it Nadar expressed his anti-imperialist sentiments by representing Napoleon III being ignominiously kicked out of the procession of great Frenchmen. An ardent Republican, who had played an active part in the Revolution of 1848, Nadar never photographed the Emperor, but apart from him there were few prominent Frenchmen whom he could not claim to have fixed with his lens.

In the mid-1850s Nadar became so engrossed in a new field, ballooning (see chapter 39) as well as magazine work, that he left the photographic studio in charge of his brother, who began calling himself 'Nadar jeune'. In 1859, after obtaining an injunction restraining Adrien from using his pseudonym, Nadar opened another studio at 35 Boulevard des Capucines. The house, painted bright red all over as a manifestation of the photographer's political convictions, and with 'NADAR' in gigantic letters across its entire façade, became the meeting place of intellectuals. 'This king of photographers', as Léon Daudet called Nadar, left to posterity an incomparable collection of photographs[4] of the intelligentsia of Paris during the Second Empire and the Third Republic. His portraits, many of which were later on published in the series *Galerie Contemporaine*, include Berlioz, Liszt, Wagner, Gounod, Meyerbeer, Corot, Delacroix, Manet, Daumier, Alexandre Dumas, father and son, Baudelaire, Victor Hugo, Flaubert, Théophile Gautier. Nadar excused himself from Pl 199 photographing women 'because the images are too true to Nature to please the sitters, even the most beautiful'. Exceptions were the young Sarah Bernhardt, George Pl 200 Sand, to whom Nadar dedicated his book of short stories *Quand j'étais étudiant* (1858), and Christine Roux, the original 'Musette' of Murger's *Scènes de la Vie de Bohème*. The pose of the latter is very close to *La Source* by Ingres, painted in the same year, 1856. As Ingres was in the habit of sending his sitters to Nadar's studio for preliminary photographs, the nude 'Musette' may be assumed to be one of a series of studies for Pl 203 *La Source*.

Nadar's prints in the 1850s were larger than those of other portrait photographers, measuring 18 cm. × 24 cm. (8 in. × 10 in.) and his charge of 100 francs considerably higher. After the carte-de-visite became the rage in Paris in 1859, Nadar had to adopt the new format, for which he charged 40 francs a dozen–double the usual charge. As Disdéri had foreseen, business greatly increased with the cheaper *cartes*, and Nadar could afford to employ a number of assistants to whom he handed over the rank and file of sitters, reserving the most distinguished to himself.

Nadar's sensational exploits with his balloon *Le Géant* made him an international figure in the 1860s (see chapter 39). During the Siege of Paris 1870-1 Nadar commanded an observation balloon corps, and also provided at his own expense a balloon postal service to the seat of the Delegate Government at Tours–later Bordeaux. Yet he received no honour in recognition of this war service, for being an ardent republican he had sided with the insurgents and was lucky to escape the repression that followed the triumph of the reactionary Versailles Government.

Paris made a remarkably quick recovery from the destruction of the siege and the Commune, and before long Nadar's studio was again crowded. In 1872 he opened new premises in the Rue d'Anjou St Honoré, keeping on his studios at 35 Boulevard des Capucines, which he generously lent to the future Impressionists for their first exhibition in April–May 1874. Monet wrote in gratitude: 'Nadar, the great Nadar, who is as good as bread, gave us his place.' Whether Nadar's appreciation of modern art was ahead of that of official circles (as was the case a generation later with Stieglitz and Steichen) or whether he merely relished the publicity of the attendant uproar, is difficult to judge.

At this period Nadar employed an artist named Vienseuf to paint over enlarged portraits. A half-length painted portrait cost 1,000–2,000 francs, full-length 3,000–4,000 francs. This was a high price indeed, but these hybrid photo-paintings were regarded as 'genuine masterpieces' by Nadar's clients.

'*To love life* is the gift of poets, the supreme gift, and Nadar had it as no-one else', wrote Léon Daudet, one of his innumerable friends. This love of life kept Nadar active after his retirement from photography in 1886. That year he and his son Paul–now in charge of the studios–pioneered the photo-interview (see chapter 36). In 1891 Nadar founded the magazine *Paris Photographe* with Paul as editor. His many books include an autobiography *Quand j'étais photographe* (1899) and a biography of Baudelaire which was published the year after Nadar's death at the age of ninety. Thus until the end, this man of many talents, and one of the most colourful personalities in the history of photography, proved his unbounded vitality.

In addition to Nadar there were a number of other well-known Parisian photographers contemporary with him. Of these the most outstanding was ÉTIENNE CARJAT, writer, caricaturist, and editor of *Le Boulevard* 1862–3. To Carjat photography was only a part-time occupation from 1855 to 1875 when he sold his studio.

Pls 201, 202

Like Nadar, Carjat captured character and expression brilliantly. Indeed, some of his portraits of celebrities, e.g. Rossini, Baudelaire, Halévy and Gambetta, are livelier and more intimate than Nadar's and have been undeservedly overshadowed by the latter's greater reputation.

The Vicomte d'Arnoux, better known under his pseudonym BERTALL, was another leading Parisian caricaturist and book illustrator, who was also active for some years as a portrait photographer of celebrities–and the *Galerie Contemporaine* affords ample opportunity for studying the physiognomy of France's great men in literature, art, music, science and politics as seen by her great photographers. These fine $7\frac{1}{2}$ in. × $9\frac{1}{2}$ in. carbon prints are in most cases the best likenesses of the subjects that have come down to us.

ANTOINE SAMUEL ADAM-SALOMON was a successful sculptor (he made busts of Guizot, Thiers, and Pope Pius IX, among many others) when the excellent work of his neighbour, the English photographer R. J. Bingham, decided him to take up photography in 1858. However, like Carjat, Adam-Salomon devoted only part of his time to photography–in fact he received sitters for only 2 hours each day. His charges were high: 100 francs (then equal to £4) for the first copy of a 10 in. × 8 in. portrait, and 25 francs each for further copies, as against 25 francs for a dozen *cartes* or 40 francs for a dozen Cabinet photographs charged by the leading portrait establishments.[5] But exceptional excellence warranted exceptional prices, and all critics were impressed by the singular relief and modelling, due to the sculptor's knowledge and feeling for lighting the sitter, who 'becomes in his hands only a little less plastic than the modelling clay upon which the sculptor is accustomed to work'. *The Times* pronounced his pictures 'the finest photographic portraits in the world'. Lamartine, who had hitherto despised photography, was completely converted by Adam-Salomon's work to believe in it as an art form. In England, the editor of *Photographic News* wrote enthusiastically of Adam-Salomon's portraits after the Paris 1867 Exhibition. So did H. P. Robinson in *Pictorial Effect in Photography* (1869): understandably so, for Adam-Salomon was a kindred spirit, trying his best to raise photography to an art comparable with painting. The painterly artifices of draping the sitter in velvet, posing him *à la* Rembrandt, Van Dyck, or one of the other Old Masters, naturally appealed to critics who had not yet learned to appreciate the camera's image and who believed that by such devices photography could be infused with art. With changed outlook, Adam-Salomon's work must naturally be revalued. It was greatly overrated. His portraits fail to come alive. Many do not rise above the carte-de-visite level, for Adam-Salomon relied for many of his effects on studio properties, which reduce the sitter to playing a part in a composition, and on excessive retouching. It is the more surprising therefore that P. H. EMERSON, the champion of 'naturalistic photography' in the 1880s, dedicated his book of that title to the memory of one so artificial in style. Pl 205

LEWIS CARROLL (Rev. Charles Lutwidge Dodgson) had his interest in the new art aroused by watching his uncle photographing in 1855. By the following year photography had become his main hobby, which–as his copious diary entries prove–he pursued with devotion for the next twenty-five years. There is something highly stimulating in the act of creating a picture by light and chemicals, and Lewis Carroll's amusing parody of Longfellow, *Hiawatha's Photographing* (1857) was based on his own experience in posing family and friends. Yet despite the difficulties he encountered it was to such creation that Lewis Carroll was so attracted, and his dreamy pictures of his little girl friends display a fertility of imagination and creative power equal to the genius of the 'Alice' books. Significantly, his manuscript *Alice's Adventures Under Ground* bears on the last page his photograph of the child for whom he wrote it. Significantly, too, Lewis Carroll gave this thumbnail sketch of himself: 'My own figure is perhaps a *little* inclined to the robust; in stature I am none of your military giraffes–but why should I describe myself? My photograph (taken by myself) will be sufficient evidence to the world.'[6] Pl 210 Pls 206, 207

Most of Lewis Carroll's photographs were taken in his rooms at Christ Church, Oxford, where he was lecturer in mathematics from 1856 on. These rooms were the delight of all the children entertained there, being a veritable paradise full of toys, games, and fancy-dresses. It is amusing to think of the staid don, who was 'almost old-maidishly prim with grown-ups', completely unbending in the company of his little visitors, nearly always girls. He summed up his feeling in the cryptic remark, 'I am fond of children, except boys.' The amusements provided made the children willing participants in the serious task of keeping quite still for the photograph, for Lewis Carroll's usual exposure of about a minute seemed an eternity to them.

When photographing in London Lewis Carroll would take a portable dark-tent and all the necessary equipment along in a cab to the sitter's home. This was no light undertaking; it demanded tremendous enthusiasm, but it resulted in a variety of attractive backgrounds, such as he found at Lambeth Palace and in D. G. Rossetti's Chelsea garden, so that the danger of monotony was avoided.

Though he disliked being photographed himself, Lewis Carroll never tired of pressing others to sit for him. Of approximately 3,000 photographs which Lewis Carroll methodically numbered, indexed, and stuck into albums, a fair proportion are portraits of celebrities, revealing him as an indefatigable lion-hunter. Yet due to the close personal contact, the poses of his child sitters are usually much more spontaneous and original than his portraits of the famous, and we would like to think that their sprawling signatures meant more to him than the imposing autographs underneath the more conventional portraits of celebrities.

Lewis Carroll's best photographic work dates from the 1860s. During the next decade he was unfortunately rather pre-occupied with dressing up his little friends, or undressing them, and the attendant banality does not fail to strike one painfully in comparison with the extremely sensitive earlier work in which he achieved an excellence which in its way has not been surpassed. The author's re-discovery of Carroll's photographic *opus* twenty years ago[7] brought to light an aspect of his life that had been completely forgotten, and is still the subject of discussion among psychologists.

In the German-speaking countries and Italy no portrait photographer was sufficiently outstanding to rank with those discussed above, though good work was produced by the Viennese court photographers LUDWIG ANGERER and RABENDING, Pl 208 HERMANN KRONE of Dresden, C. SCHWARTZ and THEODOR PRÜMM in Berlin, C. BRASCH in Leipzig, and JOSEF ALBERT in Munich. In Italy and other poor countries it seems that there was no demand for large portraits, only for cartes-de-visite.

Pl 204 MATHEW B. BRADY has such a tremendous name with the American public that he must be referred to in this chapter, though judging from the best source-books[8] Brady's portraits of celebrated Americans do not rise above the level of those of a competent carte-de-visite photographer. Only a very uncritical mind could have placed them on a par with D. O. Hill and Julia Margaret Cameron,[9] and a comparison even with Disdéri would seem generous, though the rise and fall of their professional fortunes has certain parallels.

Brady's chief importance lies in the fact that he was the photographer of an era, and was responsible during forty-eight years for photographing every American of note, including (with one exception) every President of the United States from John Quincy Adams to William McKinley. On more than one occasion Abraham Lincoln remarked, 'Brady and the Cooper Union speech made me President of the United States.'[10]

Brady approached the portrait business with the same historic sense and desire for completeness, as he did his Civil War documentation. 'The fact that Mathew Brady sought you out to take your picture meant that you were "news". You could be notorious, or interesting, or famous. You need not necessarily be good and great.'

The visit of the Prince of Wales and his entourage to Brady's New York gallery in October 1860–and he was the only photographer so favoured during the Prince's tour of the United States–naturally greatly boosted Brady's business. At its peak the following year, Brady's New York and Washington studios turned out over 30,000 portraits. In a business on so vast a scale it is obvious that comparatively few of the photographs bearing Brady's stamp could have been taken by him. Yet few people can have been prepared for the revelation of Brady's latest biographer[11] that by 1851 his eyesight was failing so much that he could no longer handle the camera himself. However, in view of later descriptions of sittings with Brady himself, it must be supposed that this was a temporary affliction.

26 Mammoth and miniature photographs

ENLARGING

The desire to enlarge photographs arose naturally from the inability of the early daguerreotypists and calotypists to take fair-sized pictures with exposures of a reasonable length. Long exposures mattered less with inanimate subjects like architecture and scenery, but had to be avoided for portraiture, and this was the reason for ALEXANDER WOLCOTT's enlarger, patented in March 1843. Richard Beard had attained fairly short exposures at the expense of being restricted to a very small plate size (see chapter 12) and undoubtedly his clients often expressed the wish for bigger portraits. Wolcott's arrangement amounted to rephotographing the original daguerreotype on a larger scale, in a camera at one end of which the original was placed, and at the other a larger silvered copper plate or a piece of calotype paper. A slanting aperture at the top of the camera admitted light on to the daguerreotype to be copied, and the polished surface of this reflected it through a system of achromatic lenses on to the sensitive material. In the case of a daguerreotype the enlarged picture was no longer laterally transposed. By adjusting the relative distances of the lens and the reflecting and receiving surfaces, copies of various sizes could be made.

Before Wolcott, PROFESSOR JOHN W. DRAPER of New York had been experimenting with enlarging daguerreotypes (in 1840), but for a different purpose. He was concerned with 'the possibility of diminishing the bulk of travellers' daguerreotype apparatus, on the principle of copying views on very minute plates with a very minute camera, and then magnifying them subsequently to any required size by means of a stationary apparatus'.[1]

FOX TALBOT, too, is known to have practised enlarging, for small negatives have been found of some of the larger views published in *Sun Pictures in Scotland* (1845). Talbot patented an enlarger only a few months after Wolcott (in June 1843) but the wooden box measuring 2 ft× $6\frac{3}{4}$ in.× $6\frac{3}{4}$ in. made for him by Kemp of Edinburgh, and preserved at the Royal Scottish Museum, may be of later date. Talbot's enlarging system does not seem to have differed from Wolcott's. The small negative was inserted at one end and, by means of a lens in the middle, a larger positive was printed at the other end. For such a moderate degree of enlargement as Beard and Talbot desired, a simple long box was sufficient.

Other early enlargers were made by T. & R. WILLATS in 1847 for Dr W. B. Carpenter to enlarge microscopic objects as illustrations for his work on physiology,[2] and by J. J. HEILMANN of Pau, whose simple apparatus was described and illustrated in *The Athenaeum* on 9 July 1853.[3]

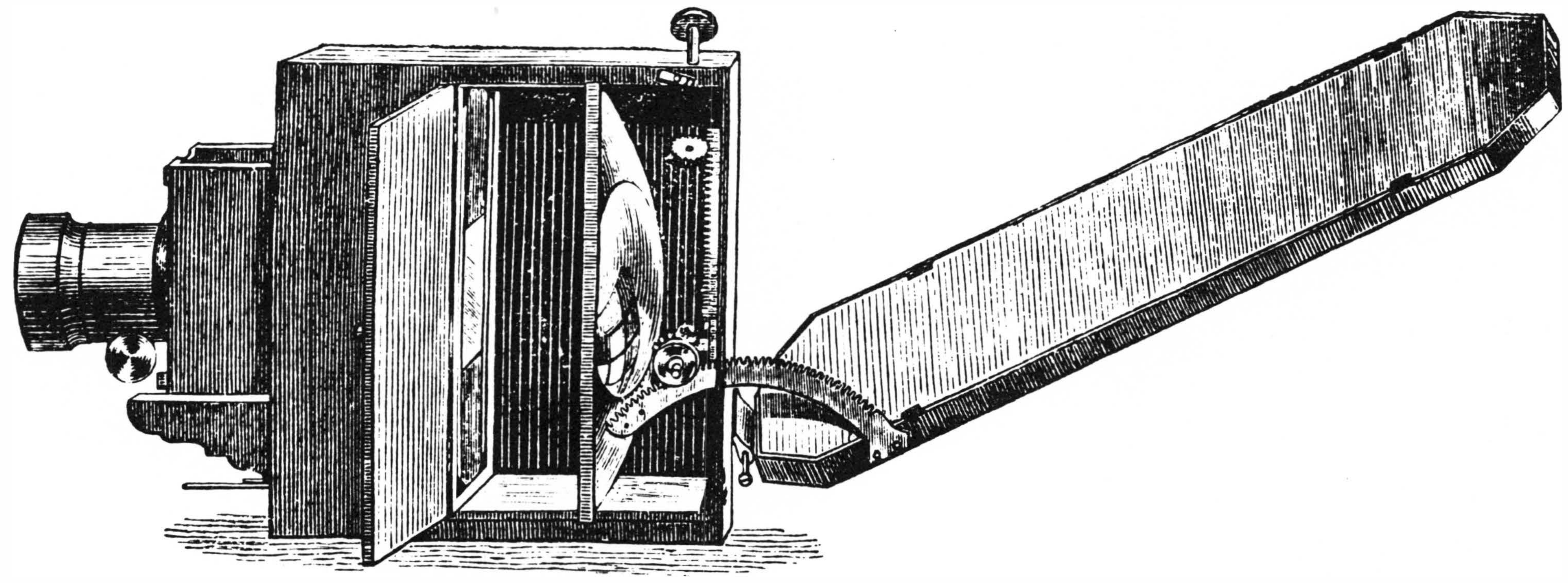


Fig 43 Woodward's enlarger, 1857

Fig 43 The 'solar camera' patented in 1857 by **DAVID A. WOODWARD**, a photographer and professor of drawing at the Government School of Design, Baltimore, was an adaptation of the solar microscope in use since 1740. It was made in two sizes: (1) fitted with a 9 in. condenser for half-plates, it cost £21; (2) with a 5 in. condenser for quarter-plates, £13. The solar camera was a considerable improvement on previous enlargers, and Woodward explained that it originated in his desire to make enlarged copies of photographs on canvas to paint over. He proved his point by showing a life-size half-length portrait (18 in. × 22 in.) enlarged from a half-plate negative in 45 minutes.[4] Despite the apparent advantages of enlarging, the solar camera was not used to a great extent, for those who wanted large pictures preferred to take them on large plates, without being involved in a second operation.

The well-known microscopist **GEORGE SHADBOLT** was among the few far-sighted people who believed that the future of photography lay in enlarging small instantaneous photographs in order to overcome the regrettable absence of life in larger negatives.[5] But although a number of ingenious miniature cameras were constructed (see chapter 20) few used them except their inventors.

With the new fashion for *carte* portraits in 1860, the need for enlarging arose afresh. It was not unusual for a client to ask for a larger copy of his favourite *carte* portrait, and however much the photographer tried to persuade him to have a new portrait taken on a larger plate, the client would usually insist on an enlargement of the portrait which he knew, rather than risk getting something he might not like.

It was chiefly due to **ANTOINE CLAUDET**'s enthusiasm for Woodward's instrument that its introduction into Europe met with success. Claudet read a paper on it before the British Association in 1860, and exhibited life-size portraits made from *carte* negatives at the International Exhibition, London, 1862. The Austrian court photographer Viktor Angerer (brother of Ludwig) travelled specially to London to see Claudet's enlarging arrangements, which he introduced in Vienna.[6]

In Woodward's solar camera, the negative was placed in the back of the instrument, which was set up in a darkroom at an opening in the window-shutter, preferably facing south. A mirror projecting through the aperture reflected the sun's rays on to a condenser which concentrated the light on to the negative and thence through a lens on to a screen in the room. As enlargements on printing-out albumen paper required several hours' sunshine, Blanquart-Evrard's paper with development was usually employed (see chapter 15) and this reduced the exposure to 10 minutes to half an hour in sunshine. On dull days, enlargements were usually made on wet collodion, in order to keep the exposure to a reasonable length. In this case the negative was replaced by a diapositive, so that the enlarged image on the collodion plate was a negative one for making contact copies. Whenever several enlargements from the same negative were required, this remained the most usual method, at any rate in northern latitudes, until the 1890s. (For single enlargements, direct enlarging on fast bromide paper ousted the diapositive method after 1880.)

In order to keep the sun's rays constantly centred on the condenser it was necessary to move the mirror frequently, and, apart from the inconvenience, the movement was always liable to shake the camera, producing an unsharp enlargement. The desirability of separating the mirror from the enlarging camera was pretty obvious, and it is somewhat surprising that a shrewd businessman like Disdéri was willing, in 1860, to pay 20,000 francs (then £800) to JACOB WOTHLY of Aachen for the rights of this simple improvement. The previous year Woodward had sold the patent rights in his solar camera for France and Belgium to Bingham & Thompson of Paris for 5,000 francs. Soon it became general practice to have a separate mirror; those who could afford it bought a heliostat in which a mirror is moved by clockwork so that it rotates with the same angular velocity as the sun, reflecting its rays constantly in the same direction.

Subsequently to Woodward's, several other solar enlargers were introduced, of which the best known were ADOLPHE BERTSCH's megascope (1860), and D. VAN MONCKHOVEN's and ALPHONSE LIÉBERT's solar cameras, both 1864. The megascope was specially designed in conjunction with Bertsch's miniature camera taking negatives 2¼ in. square. Because of the small size, it was possible to dispense with the camera body and with the condenser. The instrument consisted simply of a lens combination in an adjustable brass tube which was put in the aperture in the window-shutter. A diapositive was inserted in the tube for enlargement on a wet collodion plate, which was fixed on a movable screen. The sunlight was reflected direct on to the diapositive from a mirror attached to the outside wall.

In MONCKHOVEN's instrument, which is preserved at the Musée de l'Histoire des Sciences, Ghent, a meniscus lens was placed between the condenser and the negative (or diapositive) to give more even illumination, and to correct the spherical and chromatic aberration of the condenser. The sunlight was concentrated by a separate mirror, or a heliostat, outside the window.

All the previous enlargers described, from Wolcott's to Monckhoven's, were *horizontal*, and used in a darkroom. LIÉBERT's was a closed instrument for use in the Fig 44

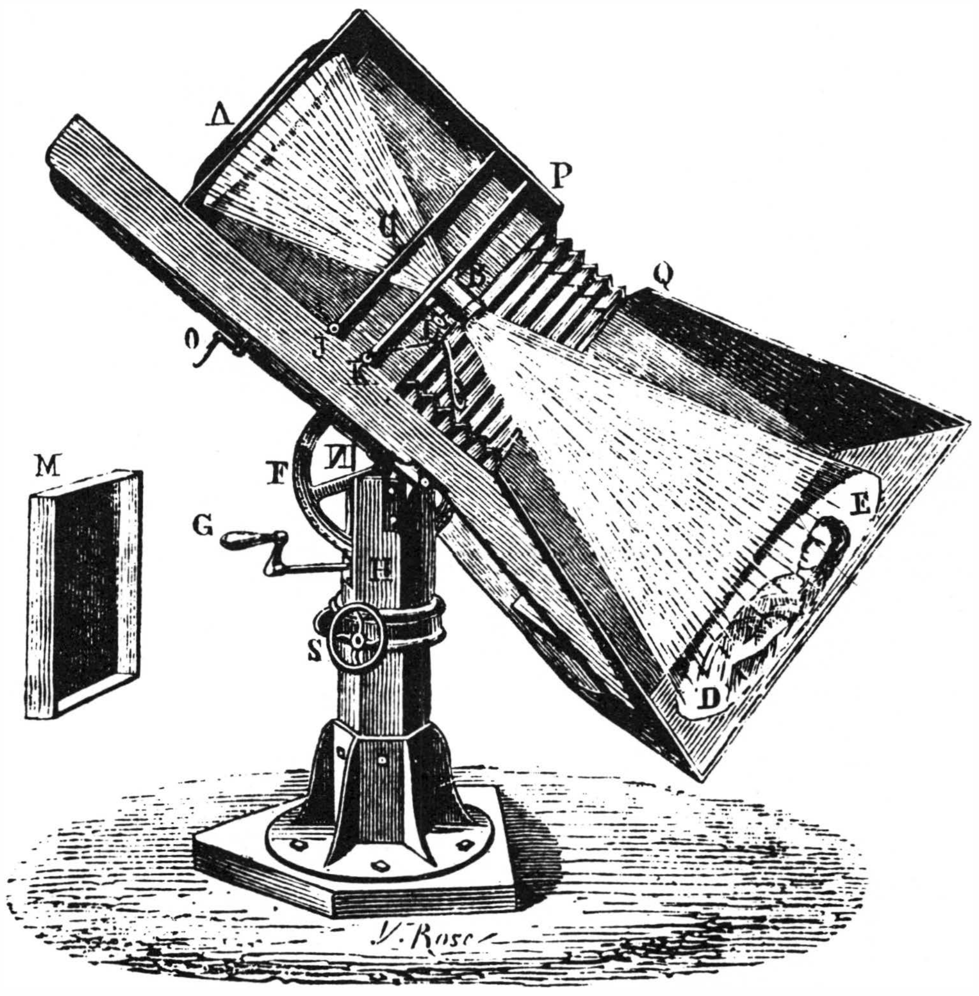
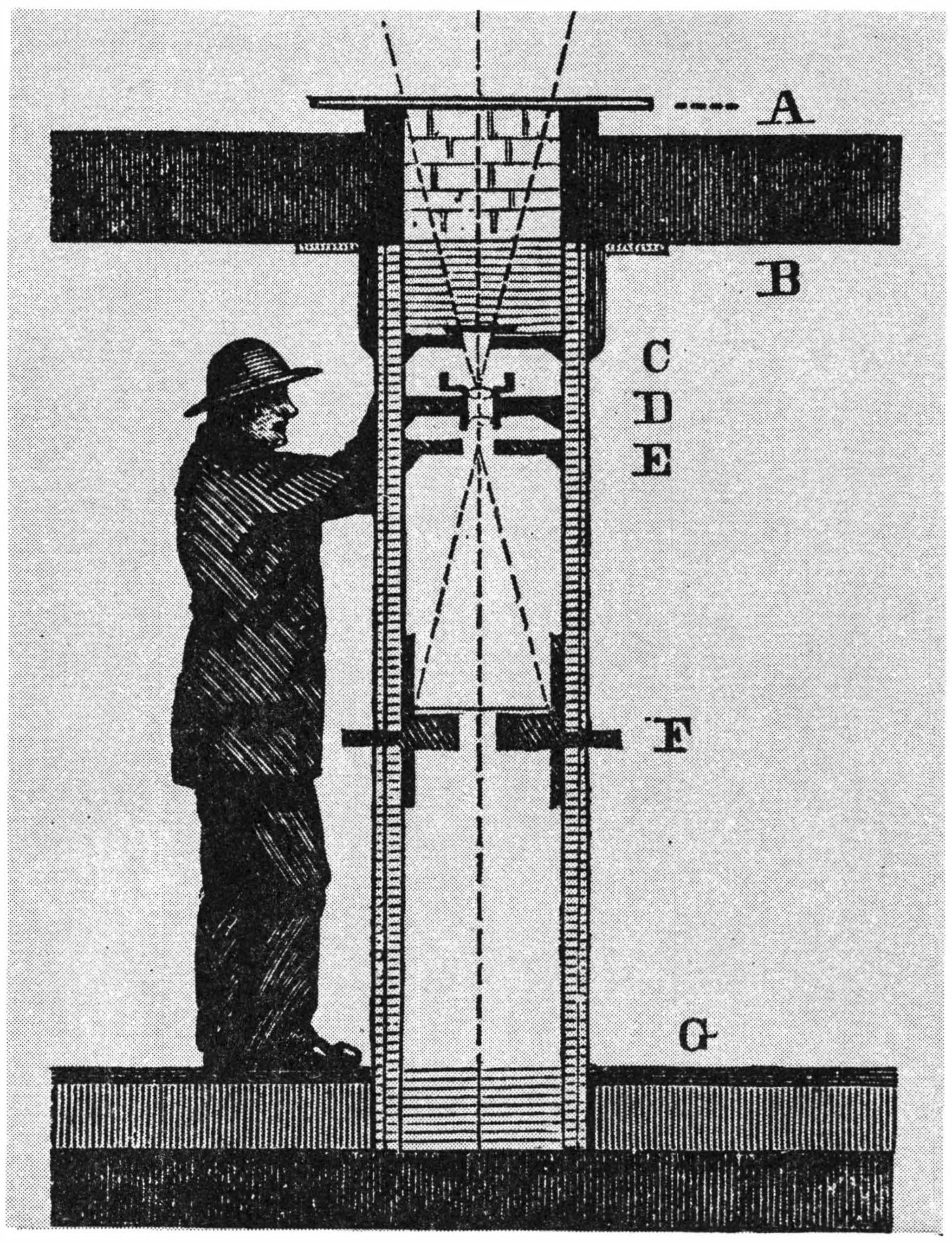


Fig 44 Liébert's enlarger, 1864



A. A sheet of glass to keep out dust or rain. B. Roof, with a hole in it. C. Box and slide to hold the negative. D. Slide for the lens. E. A board to shut off light. F. Sliding table for the focusing-screen and sensitive surface. G. Floor.

Fig 45 J. F. Campbell's enlarger, 1865

open air. It was supported on a stand with a rack-and-pinion movement so that it could be pointed towards the sun, whose rays shone directly on the condenser, dispensing with the mirror. As the instrument was out of doors, it could be used from sunrise to sunset. The progress of the enlargement could be observed through a yellow window in the side of the instrument. At the Vienna Photographic Exhibition (1864) Liébert showed several portraits enlarged from carte-de-visite size to $17\frac{3}{4}$ in. × $23\frac{1}{2}$ in. on albumenized paper, at exposure times varying from 45 minutes to 70 minutes.

The apparatus of Liébert (who lived in Nevada and California) was manufactured in Philadelphia and was the most frequently used enlarger in America, whilst Woodward's solar camera established itself as the most usual type of enlarger in France. There was more demand for enlargers there than anywhere else in Europe, and the only manual on the subject known to us is French.[7]

The first *vertical* enlarger was devised by QUINET of Paris in 1852. Six years later Fig 45 J. F. CAMPBELL fitted his camera in a hole he had made in the roof (most photographic studios were in the top storey) and enlarged on to a table beneath. In the following years Campbell elaborated the idea into a proper apparatus with all the refinements of a present-day plate enlarger, which it greatly resembles, with the exception, of course, that Campbell used daylight as his light source.[8]

OLIVER SARONY of Scarborough did brisk business in the early 1870s with a secret enlarging process, charging £10 to £30 a time for a licence, according to the size of the town. A photographer in Leicester purchased the exclusive right for that town for £15, but instead of making £150 to £200 a year out of enlarging, as he had hoped, he had to bring the matter into court because Sarony's agent had 'by mistake' sold a second 'exclusive' licence to another Leicester photographer.[9]

It will have become clear from the preceding pages that before the advent of fast bromide paper in the 1880s, enlarging was troublesome, and apart from leading portrait photographers who had a frequent demand, it was confined to specialists who took in outside work, both for professionals and amateurs. Quite a number of amateurs used stereoscopic cameras and other comparatively small plate sizes, such as 3¼ in. × 4¼ in. and 5 in. × 4 in., with the result that photographic journals from the early 1860s onward frequently contained advertisements of enlarging services. Aldis of Baker Street, London, advertised in the *Photographic News* of 1 January 1864 that 'he is prepared to enlarge photographs by artificial light to any size up to 40 in. × 26 in.' stipulating that 'Heads intended for life-size ought not to measure less than ¾ of an inch in the negative.' R. L. Elliott of London advertised, for example, in July 1868 'bold and sharp life-size enlargements by the sun or by limelight, according to the state of the weather', and guaranteed delivery within three days. His charges were 3*s.* 6*d.* for a 15 in. × 12 in. enlargement, 5*s.* for 20 in. × 16 in., and 17*s.* for 40 in. × 26 in., the largest size he could undertake.

It was no doubt because Julia Margaret Cameron was afraid lest some of her imposing portraits might be mistaken for enlargements that she sometimes felt it necessary to inscribe them 'From life, not enlarged.' But if she disdained the convenience of working with normal sized plates, fearing that the quality of her work would suffer by enlarging, Mrs Cameron failed to realize that the impact of her powerful portraits on the spectator was lost in the *carte* and cabinet sizes which she published at Colnaghi's.

MAMMOTH PHOTOGRAPHS

In Paris, producing mammoth photographs became a favourite advertising stunt of photographers in 1860–1. Édouard Delessert's 6 ft × 5 ft (190 cm. × 155 cm.) photograph of a pony, made on nine sheets of paper, and Mayer & Pierson's full-length life-size portrait of Napoleon III drew gaping crowds, few of whom had any idea how the pictures were made.[10] 'CHAM' (Amédée de Noé) poked fun at the 'life-size' Fig 46

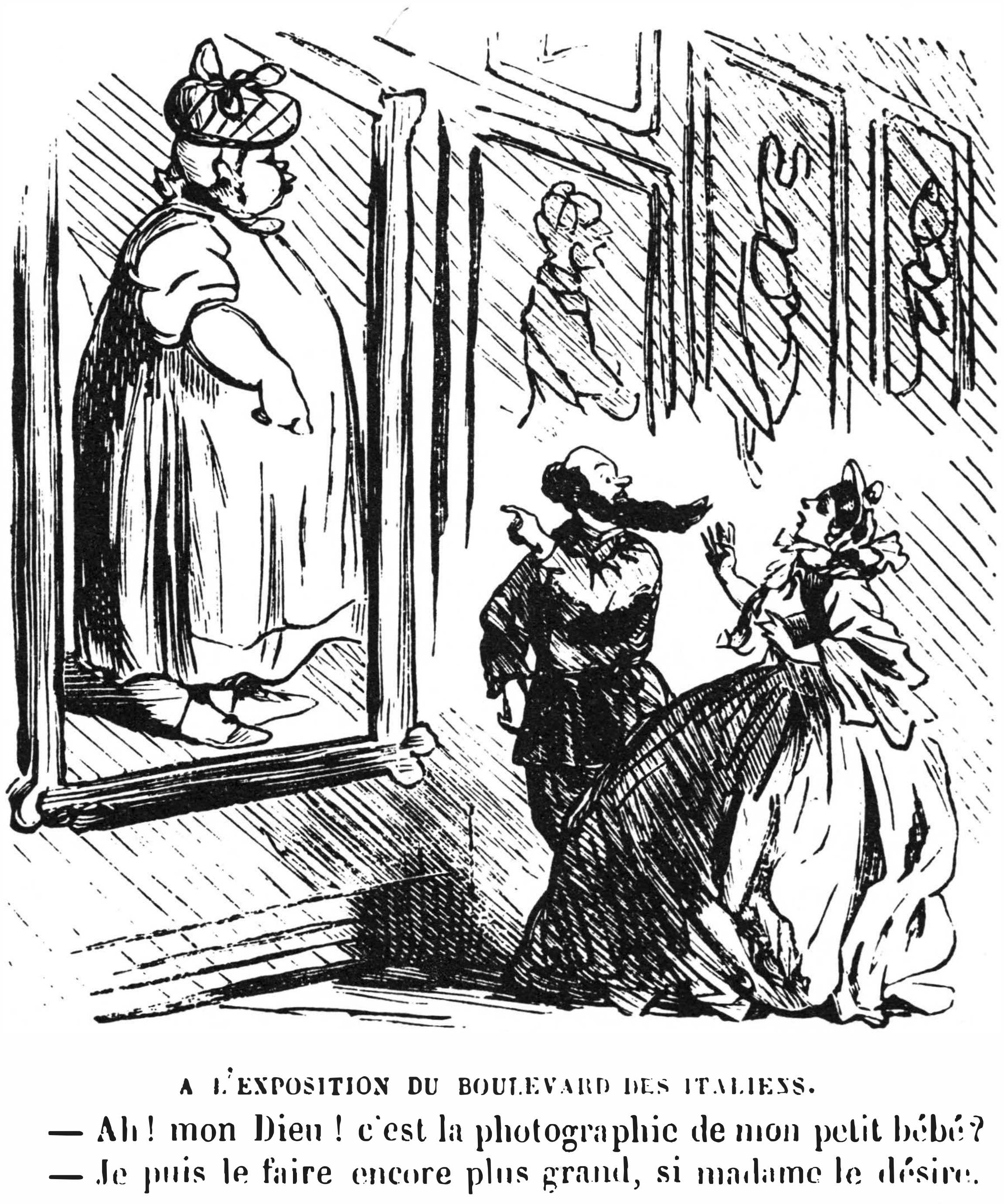

A L'EXPOSITION DU BOULEVARD DES ITALIENS.
— Ah ! mon Dieu ! c'est la photographie de mon petit bébé?
— Je puis le faire encore plus grand, si madame le désire.

Fig 46 Caricature by 'Cham' of Disdéri's 'life-size' portraits, 1861

portraits of Disdéri, which were all the rage. An enlargement of a flea to a height of one metre, the work of a French amateur, was considered one of the most startling exhibits at the Photographic Exhibition in Vienna, 1864.

These life-size enlargements had to be printed on several pieces of paper joined together. The quality was usually poor, necessitating considerable retouching on the joins, even to the extent of over-painting the whole picture to hide defects.

Before 1860, very large photographs were made by specially constructed giant cameras. C. THURSTON THOMPSON, the official photographer at the South Kensington Museum, London, worked with a camera 39 in. square × 12 ft long, which ran on rails. With it he reproduced the Raphael cartoons–then at Hampton Court Palace–in 1858, on glass plates 36 in. square. Probably the largest camera constructed in the nineteenth century was that of a Glasgow amateur, JOHN KIBBLE, in 1858. The lens designed for it by Andrew Ross had a diameter of 13 in., a focal length of 6 ft, and cost £170. The glass plates measured 44 in. × 36 in. and each weighed about 44 lb. This did not inconvenience Kibble who was accustomed to handling large panes of glass since he was a greenhouse constructor by profession. This monster camera was mounted on wheels and drawn by a horse on Kibble's photographic outings. A particularly famous landscape taken with it–a glass transparency of Broomielaw–was regarded with astonishment at photographic exhibitions, for no other reason than that it was the largest on record.[11]

Even Kibble's camera was dwarfed by the one constructed by a Chicago firm in 1900 for GEORGE R. LAWRENCE. This, the biggest camera ever made, took pictures 4½ ft × 8 ft–more than three times the size of Kibble's. It measured 20 ft when extended, and was officially named 'The Mammoth'. Still more staggering than the size was the weight of the apparatus, 900 lb., and of the plate holder, when loaded, 500 lb., totalling 1,400 lb.[12] The plate, which had to be specially made and coated in this size, cost £40 and four men were needed to handle it. Two lenses were specially made by Zeiss, a wide-angle of 5½ ft focal length, and a telescopic rectilinear of 10 ft focal length. The camera was transported on a special railway truck 20 ft long pulled by a locomotive. The taking of a photograph required the services of fifteen men, and, on the average, an exposure of 2½ minutes. Five gallons each of developing and fixing solutions were needed, and the production of each print cost between £6 and £7. With this camera, the Americans lived up to their reputation for doing everything on a bigger scale than anyone else. To what purpose? it may be asked. The Chicago & Alton Railroad Co. wanted perfect photographs of its new luxury express to be taken in one shot instead of being made up from two or three views pasted together. The camera was also used to photograph large interiors. One of Swift & Co., Chicago, was illuminated with 300 charges of flashlight powder arranged round the premises.[13]

Photographic panoramas. The nineteenth-century popularity of painted panoramas naturally led to photographic panoramas. One of the earliest was a view of Cairo by Francis Frith, made up from seven negatives and over 8 ft long. When shown at the Photographic Society's exhibition in London in December 1858 it was regarded as 'one of the wonders of photography'. GEORG BÖTTCHER, a Munich copperplate engraver, in 1858 took eleven photographs from the tower of the Peterskirche which he combined into a panorama 6 metres (19½ ft) long. The following year SINIGAGLIA of Padua showed at the Paris Salon a panorama of Venice nearly 4 metres (13 ft) long and consisting of ten sheets of paper. In 1867 there was shown in London a panoramic photograph 35 ft long of Krupp's steelworks, made from fifteen prints which, with two exceptions, were contact copies from 22 in. × 26 in. plates. The usual difficulty of obtaining uniform depth of tone in all the sections had been successfully overcome.[14] Nine years later BERNHARD OTTO HOLTERMANN, a German-born settler who had made a fortune in the Australian gold-fields, exhibited at the Centennial Exhibition in Philadelphia a panorama of Sydney 30 ft long, printed from six negatives 5 ft × $3\frac{1}{2}$ ft–the largest wet-plate negatives ever made. The pictures were taken by CHARLES BAYLISS and himself from a specially built tower 74 ft high. The camera had a lens of 100 in. focal length, and was 10 ft long. Holtermann and Bayliss carried out the entire processing in its interior.[15] It probably remained the largest photographic panorama until 1903, when the Germans boasted of having produced the largest photograph in the world. Pl 211 This gigantic picture of the Gulf of Naples, measuring no less than 39 ft × 5 ft, was produced by the NEUE PHOTOGRAPHISCHE GESELLSCHAFT of Berlin. The difficulties to be overcome were substantial, for this panorama was to be made on one continuous sheet of paper. Big tanks had to be specially made for the developing, fixing, and washing, and a little railway track constructed on which to run them. The rinsing tank was 50 ft long × $6\frac{1}{2}$ ft wide × $2\frac{1}{2}$ ft deep. Six $10\frac{1}{2}$ in. × 8 in. negatives were each enlarged to about $6\frac{1}{2}$ ft × 5 ft on to the sensitive paper, but no darkroom was big enough for the processing, and it was decided to carry out this work in the open air at night. The exposed paper was wound round a huge wooden wheel 41 ft in circumference with a width of 5 ft 9 in. The tanks were then pushed underneath, and the wheel lowered and slowly rotated. Only for the final rinsing was the paper unrolled into the big water tank.[16] The whole intricate process was nicknamed 'Kilometer-Photographie'.

MINIATURE PHOTOGRAPHS

In recommending Heilmann's enlarger (1853) to the English public, SIR JOHN HERSCHEL expressed the hope that it would lead to the fulfilment of an old idea of his, of preserving public records, works of reference, maps, MSS., etc., on microscopically small negatives made by very small photographic apparatus. The publication of microscopic editions would then enable anyone with an enlarger to reproduce them on a readable scale.[17] Herschel's proposal for a microscopic reference library had to wait 85 years for realization, for microfilm documentation was only begun on a large scale under the threat of war, about 1938, when the most valuable books in the British Museum were copied on 35 mm. film, and some newspapers began to arrange for film copies of their old volumes to be made available to libraries. Only two exceptions in the nineteenth century are known to us; in both cases valuable MS. material was microphotographed as a safeguard against possible loss by fire. Shortly after the Paris Commune PRUDENT DAGRON was asked to reproduce all the policies of a Paris insurance company.[18] The New York publisher of an encyclopaedia had 25,000 pages of manuscripts and illustrations reduced to $1\frac{5}{8}$ in. × 2 in. each, keeping the negatives in a fireproof room.[18a]

Since the Second World War the new super-microfilm made a further hundredfold reduction possible compared with pre-war film. By 1950 all the volumes of *The Times* from its first publication in 1788 to that date had been microfilmed on 85,000 ft of film stored in 958 small boxes which occupied only 16 cu. ft. Anyone who has seen the ponderous original files will appreciate the convenience of this Lilliputian version.[19] Fifteen years later a still greater reduction became known: the 24,000 pages of a 23-volume encyclopaedia were crammed on to a piece of film no larger than 5 cm. × 5 cm. For reading, a microscope capable of enlarging at least 2,000 times is necessary. In the microprint system invented by ALBERT BONI of New York the microphotographs are reproduced in print on small cards to be read in a desk viewer.

A few months before Herschel's letter to *The Athenaeum*, a tiny photograph of a page of *The Illustrated London News* made by ALFRED ROSLING attracted great attention at the first photographic exhibition which was held at the Society of Arts in December 1852. When seen through a magnifying glass, the text could be read without difficulty. In May 1853 the idea was further developed by J. B. DANCER of Manchester, who produced the first microphotographs proper,[20] of famous people, paintings, scriptural texts, and a page of *The Times*, reduced to $\frac{1}{16}$ in. in diameter, and taken on microscope slides, to be viewed in a powerful microscope.

GEORGE SHADBOLT independently started making microphotographs in March 1854 and exhibited some at the London Photographic Society the following month. By 1857 microphotographs were an article of commerce in England, the four leading exponents in this field being Dancer, Shadbolt, Rosling, and Herbert Watkins, but the fashion for them only began in February 1859, when newspapers and scientific journals went into ecstasies over 'this new triumph in photography'–a portrait of Charles Dickens 'so exquisitely minute that its beauty and fidelity are only discovered by the use of a powerful microscope'. New microphotographic wonders (most of them several years old) were written about almost every day, such as Dancer's pinhead size photograph of the Ten Commandments containing 1,243 letters, a photographic mosaic of 155 portraits of eminent people, another with all the kings and queens of England since Egbert. One of the attractions at the International Exhibition in Paris, 1867, was a microphotograph by Prudent Dagron portraying all the 450 members of the Chamber of Deputies.

Queen Victoria, always eager for photographic novelties, wore a signet ring enclosing a group of five portraits of her family, the whole picture (made by J. B. Dancer) measuring about $\frac{1}{8}$ in. and magnified by a jewel lens. The Queen presented gold and drop-pearl pendants, each containing a tiny photograph of Prince Albert, to the Marchionesses of Ely and of Salisbury 'in remembrance of the best and greatest of Princes, from his broken-hearted widow Victoria R. Dec. 1861.'[21] She herself wore a bracelet with an enamel photograph of Prince Albert and in 1883, on the death of her favourite attendant, John Brown, presented mourning tie-pins containing his photograph.

SIR DAVID BREWSTER first put forward the idea of setting microscopic photographs in rings, brooches, tiepins, etc. When in Rome in 1857 he showed some of Dancer's microphotographs, under thick plano-convex lenses (the so-called 'Stanhope' lenses) to the Pope, Cardinal Antonelli, the Grand Duke of Tuscany, Professor Amici, and other important people, and suggested to a leading jeweller, F. Castellani, that they should be incorporated in brooches, so that the photographs might be magnified by one of the precious stones.[22] Brewster repeated this suggestion in his article on the microscope in the *Encyclopaedia Britannica* published in October 1857. In addition he made the significant forecast that 'microscopic copies of dispatches and valuable papers and plans might be transmitted by post, and secrets might be placed in a space not larger than a full-stop or a small blot of ink'.

From England, the craze for microphotographs spread to France, where Prudent Dagron patented their application to jewellery in May 1860, but owing to Brewster's prior publication his patent was set aside at the application of fifteen Parisian opticians who had found *Bijoux photomicroscopiques* a profitable novelty.

Miniature albums and tiny fans with $\frac{5}{8}$ in. photographs were carried by fashionable ladies. While these were made from carte-de-visite negatives greatly reduced, microphotographs proper demanded scientific skill. A tiny positive, such as those just described, was copied on albumenized glass through a 1 in. achromatic microscope objective, and to allow for the high degree of enlargement when viewed in a microscope the slide on which the positive was printed had to be coated with a specially fine structure-less collodion in order to give a grain-free magnified image. Although these 'photographic curiosities for the microscope', as they were labelled, can only be regarded as toys–and until the Second World War they were still sold as seaside souvenirs in the form of penholders or tiny opera-glasses incorporating a small magnifying lens over the picture–[23] more serious thought was given to practical uses for microphotographs. Forgetful lecturers could unobtrusively read their notes in the form of microphotographs set in their spectacle frames.[24] 'In a war, the most elaborate instructions might be carried in a button, or the head of a pencil-case.' 'The whole archives of a nation might be packed away in a snuffbox, and, should the communication of an army be cut off by the enemy, or in the case of a beleaguered city, a dispatch might be written and a microphotograph taken which reduced it within the limits of a square inch at the most.' Such a microphotograph, it was suggested, might be enclosed in a hollow bullet and shot over the enemy to the other line, but no advice was proffered on how to find the bullet. For spies, microphotographs have, of course, been a most valuable aid. Brewster's suggestion did not have to wait so long as Herschel's for fulfilment. During the Russo-Japanese War it was stated that the Japanese carried microphotographic reports under their nails, in their nostrils, and even in their stomachs in ivory containers which resisted the gastric juices.[25]

THE PIGEON POST

During the Siege of Paris in the winter of 1870–1, minute photographs played an important role in communications between the Delegate Government at Tours (later at Bordeaux) and the besieged capital.

On 10 September 1870 carrier pigeons were taken to Tours because the breakdown of normal communications seemed imminent. At first, the pigeons carried short hand-written dispatches on thin paper. There was always danger of inaccuracy, for the messages had to be copied many times as only a small proportion of the pigeons got through. For news from Paris, messages (and fresh supplies of pigeons) could be sent by balloon owing to the prevailing easterly winds. As the need grew for expansion of the service, the chemist BARRESWIL, who happened to be in Tours in October, suggested the reduction and multiplication of dispatches by photography, and the Inspector of Telegraph Lines, DE LAFOLLYE, was entrusted with the organization of this service.[25] The messages were written in large characters and reproduced by a local photographer by the ordinary wet collodion process on a small plate (about $1\frac{1}{2}$ in. × $2\frac{3}{8}$ in.)–a reduction to about $\frac{1}{300}$–and contact copies were made on thin paper. Owing to the facility of this method, private messages as well as official dispatches could now be sent, and for the sake of clarity the messages were set up in type. By the beginning of November, the work was so well in hand that the public were authorized to make use of the service for correspondence–maximum twenty words at a charge of 50 centimes per word.

The moment NADAR (who was in charge of the balloon service in Paris) learned that a public pigeon post was contemplated, he got in touch with PRUDENT DAGRON, who put forward to the Government the advantages of microphotography, in which he was regarded as a specialist in France, as Dancer was in England. Promising to deliver daily 200 photographs each containing 1,000 words, Dagron succeeded in obtaining a contract so remunerative to himself that the service was run at a loss. In addition, 25,000 francs (£1,000) were paid to him and 15,000 francs to his assistant

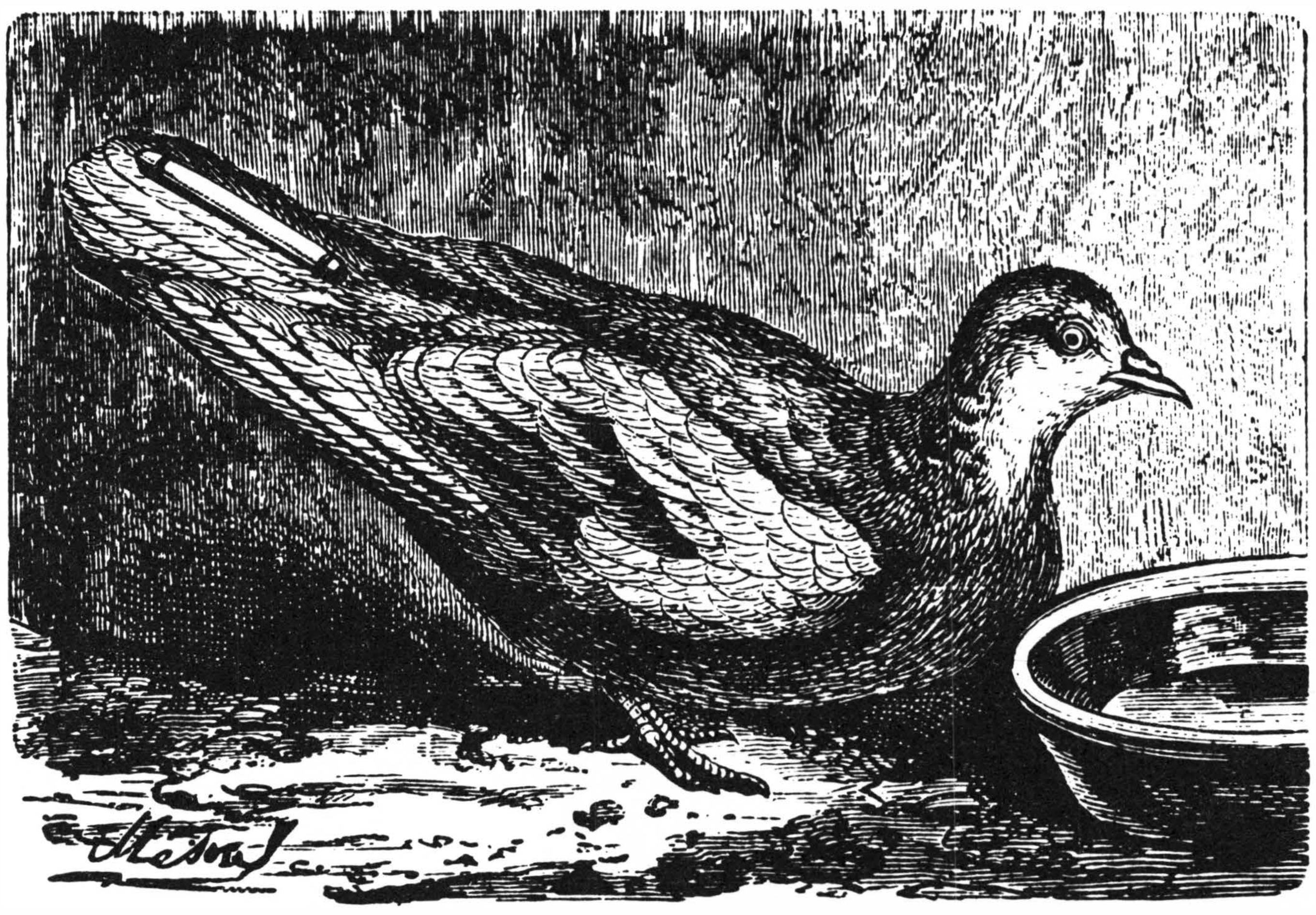


Fig 47 Pigeon with messages attached to tail feathers as employed during the siege of Paris, 1870-1

Fernique for the risks of the journey, and, in case of death, a life pension of 3,000 francs each was promised for their widows.

The Government acted promptly and on 12 November two balloons aptly named *Niépce* and *Daguerre* left Paris. The *Niépce* carried Dagron, his staff of two, and apparatus, and other passengers travelled in the *Daguerre*. Owing to unfavourable winds the balloons were blown over the Prussian lines, and the *Daguerre* was shot down and captured. The *Niépce* managed to evade the Prussians by throwing out ballast, but had to come down soon in occupied territory. Abandoning the balloon in order to divert the attention of their pursuers, Dagron and his companions were helped by friendly peasants. Changing into smocks and sabots, and packing the apparatus into wine casks on a cart, they managed to trick the Prussians into giving them permits to transport the casks of 'wine' to Tours, where they arrived on 21 November.[26]

Within a week Dagron was making good microphotographs, but when it came to mass-production in an improvised laboratory the results were not satisfactory, and –not without difficulty–the permanent official de Lafollye succeeded in inducing the new-comer to abandon the microscopical method. From the point of view of facility, rapidity, and quality, the reduction method previously in use was better, and was continued, with this important difference: instead of printing the positives on paper, they were made on collodion pellicle, which was lighter and less bulky, so that each pigeon could carry more messages.

The messages were set up in type in sheets containing about 200 dispatches, averaging fourteen words each. The sheets were arranged in groups of nine to sixteen, containing a maximum of 3,200 dispatches or approximately 44,800 words. A photograph was then taken on a dry (preserved) collodion plate $1\frac{3}{4}$ in. × $2\frac{3}{8}$ in., and contact copies printed on glass prepared with the same collodion. When covered with a thick coat of plain collodion and olive oil, and put in a weak acid bath, the positive could be stripped from the glass. After microscopic examination, the good pellicles were Fig 47 rolled up, put in a quill, and fastened to one of the larger feathers of a pigeon's tail. A message was usually ready for dispatch from Tours within five hours of receipt. Up to fifteen pellicles could be rolled together and placed in the quill, and the total weight did not exceed 1 gram. As the pigeons were untrained, and in addition harassed by hawks and falcons sent up by the Prussians, only about 5 per cent. got through, and for this reason every message was sent out again and again–on the average twenty times–until reception was advised by balloon from Paris. In this way

50,000 messages reached the city out of a total of 115,000. The total number of pellicles actually sent during the five months' siege was 2½ million.[27]

On arrival in Paris the quill was taken to the central telegraph office by the pigeon fancier. The films were soaked in water to unroll them, dried, and placed between two glass plates, and projected on to a screen by a powerful magic lantern. A staff of clerks copied the messages and sent them off to the addresses indicated by the senders. Pl 213 As the arrival of each pigeon meant many hours' work for the copiers, the firm of Cornu & Mercadier, who were entrusted with this work, tried to project the messages upon photographic paper, and eventually succeeded.[28]

Dagron proved the rapidity of the service by a personal experience. When he needed additional chemicals which were not procurable at Bordeaux (whither the photographic service, together with the Delegate Government, had been transferred on 11 December), he ordered them by pigeon post on 18 January. The message reached Paris on the 20th, and the goods arrived by balloon on the 27th, and on the same day an acknowledgment was sent to Paris.

The Times on two occasions in January 1871 devoted an entire page to inquiries and messages for transmission to Paris. These pages were photographed and printed Pl 212 by the London Stereoscopic Co. on thin, almost transparent, albumenized paper 1½ in. × 1⅞ in., and sent to Bordeaux, and thence by carrier pigeon to Paris. In introducing this service *The Times* commented: 'If a page of *The Times* can be compressed into a space little larger than that occupied by a postage stamp, the matter of an octavo volume might be made to cover not more than two of its own pages, and a library could be reduced to the dimensions of the smallest prayer-book.' So Herschel's idea was put forward again.

The pigeon post constitutes the earliest serious use of microphotographic recording, and the idea was taken up again in the airgraph service which operated between 1941 and 1945, in which by modern microfilm methods myriads of messages were flown between families in England and the fighting services in the four corners of the world. The microfilm service also enabled scientific institutions and learned societies to keep abreast of developments in enemy countries through the medium of microfilms of journals obtained from neutral sources. Owing to the paper shortage, village schools in Russia were supplied with microfilms of school-books, the pages being projected on to a screen during lessons.[29]

27 The evolution of dry plates

A DRY PERIOD AT PHOTOGRAPHIC SOCIETIES

The 1860s and 70s were a dry period in more than one sense. Photographic journals were greatly taken up with discussions of the pros and cons of innumerable new processes and modifications of old ones for negatives and positive printing, the novelty and advantages of which were ardently put forward by some and as heatedly disputed by others. The period is characterized by a great restlessness among photographers. It was a time of rapid development, new applications of photography were constantly explored, new techniques had to be mastered, new difficulties to be overcome. At the same time, the quality of collodion, the fading of photographic prints, the pirating of photographs of famous people, and many other problems caused concern at the meetings of photographic societies. These meetings were largely occupied with chemical and scientific matters to the almost complete exclusion of the aesthetic side. The parent Society in London was compared to 'the Lord Mayor's state coach–heavy, lumbering, and able only to go at a slow pace; but these are not slow times', wrote a member, 'photography is the type of the age; it won't wait. Go on we must, or we shall be run over by those behind, and it is for my fellow members to bestir themselves to prevent our Society being extinguished by the apathy of our executive, or the superior energy of rival societies.'[1] When an advocate read a paper on 'The Law of Copyright as Applied to Photographs' before the Photographic Society of Scotland, one of the members complained: 'It was a terrible infliction to listen to, being a mere repetition of lawyer's slang or phrases decanted backwards and forwards, outwards and inwards, upwards and downwards, for the space of an hour, and it was nothing when done, leaving the matter as dubious as ever.'[2]

President of the London Society was the Chief Baron of the Exchequer, Sir Jonathan Frederick Pollock, and when he was in the Chair 'everything was as dull as an old country church, and as uncomfortable as a court of justice; when I saw the venerable Judge sitting on the raised seat before me, I always felt as if I were about to be tried for my life.[3]

(SIR) WILLIAM CROOKES, F.R.S., one-time secretary of the Society and editor of their journal, was very critical of the meetings and of the conduct of affairs, and his comments in *The Photographic News*, which he established in September 1858, were often caustic:

> This gentleman's speech [he reported after a boring meeting] was interspersed with sundry small (very small) jokes, which relieved the mournful tediousness of the evening and gave some of the least grave among the members an opportunity

> of laughing. The discussion was continued for some little time longer in a languid and uninteresting manner, and soon died away altogether, upon which, after renewing the efforts he had several times made during the evening to animate the conversation, the Chairman pronounced the meeting adjourned.[4]

The Photographic News was the first photographic journal in Britain not taken up with the transactions of a society, and being independent and a weekly it was more lively and up to date than its contemporaries.

The dullness of the parent society was in no small measure due to the fourteen years' presidency of the Chief Baron and the autocratic rule of JAMES GLAISHER, F.R.S., President from 1869 to 1892 with the exception of one year. In 1874 there was an open revolt against him and his Council. 'The Photographic Society of London is menaced with revolution or dissolution' wrote *Nature*. 'If both were to befall it, the interests of Science would hardly suffer, since a more singularly inefficient organisation, under the guise of a scientific body, it would be difficult to find, or one whose results in the scientific world are so trivial.'[5] It was then that the presidency was offered for the second time to Fox Talbot, who again declined, as he had done at the time of the formation of the Society. Glaisher's reign has been described as the 'glacial age' of the Photographic Society, and anyone who looks through the sterile journals of the time will understand why. Indeed, it was not until 1892, when (SIR) WILLIAM DE WIVELESLIE ABNEY, F.R.S., accepted the Chair, that an authority on photography at last conducted the Society's affairs, though the meetings became still duller, and *The Photographic Journal* was devoted almost exclusively to scientific aspects of photography.

PRESERVATIVE OR DRY COLLODION PROCESSES

In chapter 16 we explained that the great advantage of the collodion process–its speed–was only maintained if the plate were exposed and developed in a moist state, which necessitated preparing each plate immediately before exposure, and developing it directly afterwards. (If the coating was allowed to dry, the nitrate of silver crystallized and this, of course, spoiled the picture; also the pores of the collodion contracted and the developer could not penetrate it.) The inconvenience of darkroom tents and other equipment which had to accompany the photographic tourist was so great that there soon arose a general desire for a dry plate or at least some means by which the collodion could be kept sensitive for an extended period, and this problem occupied the minds of photographers for over twenty years–until in the end the collodion process itself was superseded by the gelatine dry plate.

From the mid-1850s, various substances were introduced which had the effect of preserving the collodion coating in a sensitive state for several days or even weeks, thus allowing the entire chemical manipulation to be performed in the photographer's darkroom at home. But all preservative processes were complicated in their manipulation and considerably slower than the original wet collodion process. Indeed, exposure with any of the preservative processes was, in general, two to six times longer than with wet collodion.

Preservation could be achieved by four main methods:

1. Washing away the excess nitrate of silver, then drying it, but dipping the exposed plate once more in the silver bath directly before development.
2. Coating the sensitized collodion plate with hygroscopic substances which kept the coating moist (or introducing such substances into the nitrate of silver bath, in which case the plate could be dried).

3. Covering the plate with a protective coating, such as albumen or gelatine, and then drying it.
4. Applying a tannin solution after washing off the excess nitrate of silver. Then drying the plate.

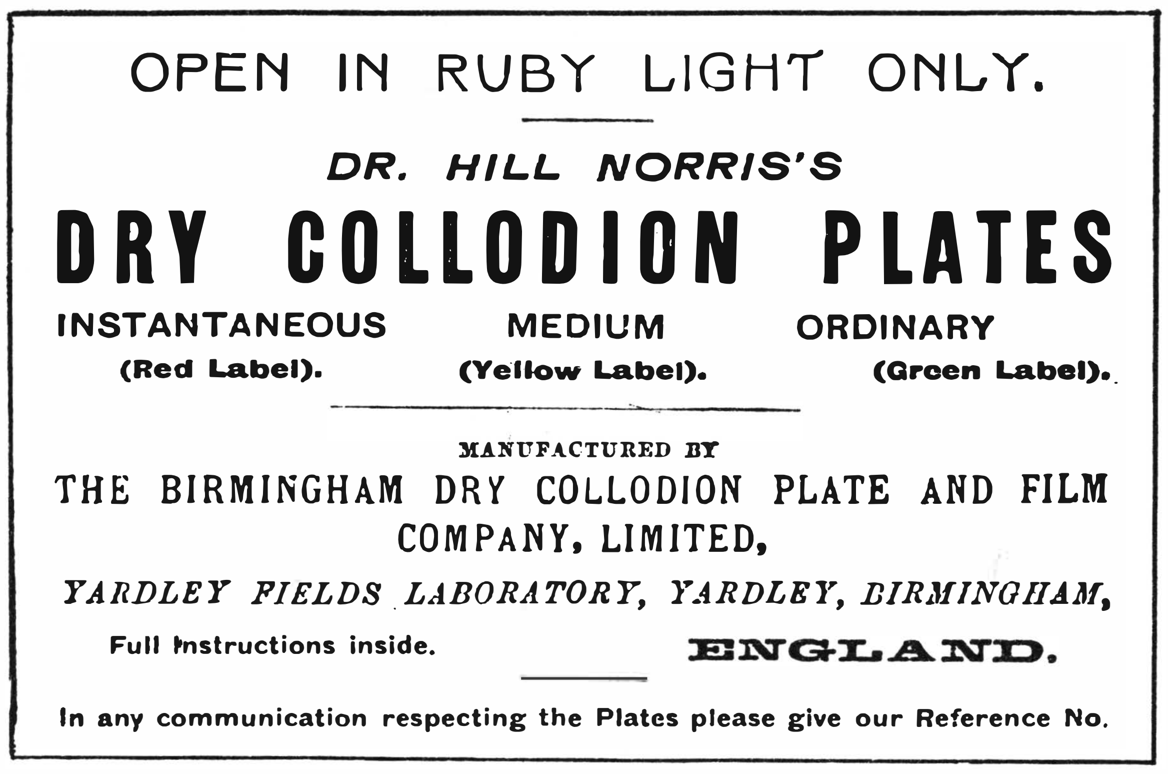
The first and second methods were suggested by MARC ANTOINE GAUDIN, in a paper on 22 April 1854, and though Gaudin's methods only preserved the plate for 'some hours', he nevertheless deserves credit for having been the first to publish a preservative process. His second method consisted in dissolving sugar in the silver bath, which permitted the nitrate of silver to dry upon the plate without crystallizing.[6]

The next preservative substance proposed was nitrate of zinc, which absorbed moisture from the air. Researching independently from Gaudin, the authors of this process, JOHN SPILLER and (SIR) WILLIAM CROOKES, claimed[7] that immersing the sensitized collodion plate in a nitrate of zinc bath would extend to five days the period of sensitivity. Soon after, they found that nitrate of magnesia was a more reliable preservative, allowing the negatives to be kept sensitive upwards of three weeks.[8] Spiller's and Crookes's researches led to much experimentation with other hygroscopic substances to preserve the plate in a 'pappy' state.

F. MAXWELL LYTE and GEORGE SHADBOLT subsequently tried out a variety of syrups, but whilst Lyte's object was mainly to increase the sensitivity of the plate (achieved in his metagelatine process, February 1857), Shadbolt aimed at the preservation of the existing degree of sensitivity for an extended period. Lyte was the first to publish the use of honey in photography, in June 1854.[9] A fortnight later Shadbolt made his honey process known.[10] This was followed by HENRY POLLOCK's glycerine process published in February 1856 and J. D. LLEWELLYN's oxymel process (a syrup of vinegar and honey) in April 1856.

From the great variety of comestibles suggested as preservatives one might appropriately call this 'the culinary period of photography'. Sugar, honey, caramel, treacle, malt, raspberry-syrup (Murray & Heath, 1858), raisin-syrup, ginger wine, sherry, beer (Charles Clifford, 1857), vinegar, skimmed milk, tea, coffee (Colonel Baratti, 1867), tobacco, liquorice, were all used. Among other substances recommended were gum arabic and morphine (Bartholomew, 1862), and this list is by no means complete, for a thousand-and-one other agents were put forward–a new process nearly every week–but there is no proof that their proposers had always progressed beyond the experimental stage, or even tested their substances at all. 'Once the imaginative faculties had been stimulated,' it was said, 'the capacity for research was enlarged by such a scientific proceeding as standing upon a chair, and from that elevated point of sight, subjecting the varied contents of the kitchen larder to scrutiny.' The formulae, indeed, often read like recipes from a cookery book, and did not fail to give rise to many jokes in contemporary photographic literature, a favourite example being the gin-and-water process, in which the liquid did not keep long.[11]

The collodio-albumen process of the French chemist DR J. M. TAUPENOT, published in September 1855, enjoyed greater popularity than any other. It was the first dry collodion process of practical utility, and among well-known photographers was favoured by Robert MacPherson in Rome and James Mudd of Manchester for architectural and landscape work. Taupenot preserved the sensitivity of the collodion plate by coating it with a film of iodized albumen, and then dipping it once more in the nitrate of silver bath, thus obtaining two sensitive layers. After this the plate was dried, and could be kept for several weeks. The only drawback was the length of the



OPEN IN RUBY LIGHT ONLY.

DR. HILL NORRIS'S

DRY COLLODION PLATES

INSTANTANEOUS	MEDIUM	ORDINARY
(Red Label).	(Yellow Label).	(Green Label).

MANUFACTURED BY
THE BIRMINGHAM DRY COLLODION PLATE AND FILM COMPANY, LIMITED,
YARDLEY FIELDS LABORATORY, YARDLEY, BIRMINGHAM,
Full Instructions inside. ENGLAND.

In any communication respecting the Plates please give our Reference No.

Fig 48 Label from box containing Dr Hill Norris's Dry Collodion plates

exposure which was about six times longer than for wet collodion (depending on the length of time the plate had been kept).

DR RICHARD HILL NORRIS of Birmingham was the first to recognize that one important function of the preservative coating was to fill up the pores of the collodion while the latter were wet and open. He contrived this by pouring over the sensitized collodion plate liquid gelatine (or some other viscous substance which would readily soften in water so that the developer could pass into the collodion). The plate was then dried and–like Dr Taupenot's–could be laid in contact with others for easy transportation. Norris's plates could be kept for six months before exposure. They were introduced commercially and though only half the speed of wet plates, were largely used between 1856 and 1866 (having been patented on 1 September 1856). The sale of plates in boxes ready for use was revolutionary, for hitherto photographers had been obliged to prepare their own.[12] To meet the great demand, Dr Hill Norris founded The Patent Dry Collodion Plate Co. in Birmingham, and by the end of September 1858 had forty retailers stocking his plates in all the larger towns of Great Britain and Canada.

In the autumn of 1860 appeared Norris's 'Extra Quick Dry Plates', the speed of which was claimed to be equal to that of wet collodion, and in addition they were guaranteed to keep up to one year. A. J. Melhuish and Francis Bedford were two of the well-known photographers working with Dr Norris's dry plates. They were supplied in packets of one dozen and the price ranged from 5*s*. for a dozen 3¼ in. × 4¼ in. plates to £2 for a dozen 12 in. × 10 in. but were made to order up to 36 in. × 24 in. In spite of reducing these prices by 15 per cent., the Norris plate survived by only two years the competition from the collodion emulsion plate of Sayce and Bolton, the manufacture of which began early in 1867. From information received from Dr Kingsley Norris, The Birmingham Dry Collodion Plate & Film Co.–as his grand- Fig 48
father's firm was styled in the 1890s–had a brief revival towards the end of the century, the plates being more rapid than the earlier ones, and suitable for instantaneous exposures. By this time, however, they could not compete with the popular gelatine plates in ordinary fields of photography, and were mainly used for process work, on account of their very fine grain.

THOMAS FOTHERGILL's process, announced in a letter to *The Times* in April 1858, was a simplification of Taupenot's. The sensitized collodion was coated with albumen, which was then washed off, retaining sufficient albumen in the pores of the collodion to allow the developer to act. From its simplicity it enjoyed a certain amount of popularity between 1858 and 1865. Fothergill's dry plates were also an article of commerce. Among other photographers, Samuel Bourne used them until he went to India, where, owing to cheap native labour, the toil of carrying equipment fell to others, and Bourne returned to the faster wet collodion.

MAJOR C. RUSSELL'S tannin process was a development of an observation by Dr Hill Norris that washing off the superfluous nitrate of silver and then pouring on the plate the usual developing solution of pyrogallic acid permitted the plate to be dried and kept several weeks. Major Russell found tannin, the substance from which pyrogallic acid is prepared, still more effective, for besides keeping the pores of the collodion open, it acted as a sensitizer. The exposure was six to eight times longer than for wet collodion, and so the tannin process published by Russell in August 1861[13] was only suitable for still subjects.

To Major Russell is also due the practical introduction of alkaline development instead of acid development as hitherto. Acting upon a suggestion of Henry T. Anthony of New York who discovered that fuming dry collodion plates with weak ammonia rendered them more sensitive, Russell in September 1862, rightly interpreting this experiment, was led to try the effect of adding ammonia (an alkali) to the pyrogallic acid developer instead of acetic acid, and found this combination a more energetic developer.[14] Independently Thomas Leahy of Dublin made the same discovery and published it a week before Russell.[15] Russell's practical working out of this system of development placed a new power in the photographer's hands, though it was not until the introduction of the rapid gelatine bromide dry plate that the real importance of alkaline development, which is still in general use, became manifest.

COLLODION EMULSION DRY PLATES

The year 1864 marked an important advance in dry-plate photography with the first workable photographic *emulsion*[16] introduced by W. B. BOLTON and B. J. SAYCE, two young members of the Liverpool Amateur Photographic Association. As with most innovations, there had been previous workers in the same field, for to dispense with the inconvenient silver bath by mixing the sensitizing solution in the collodion (or other similar vehicle) to form an emulsion,[17] which could be kept until needed for coating the plate, seemed the ideal method of working. The first attempted emulsion, of shellac, was put forward by HENRY BELLINI of London in September 1860.[18] A. GAUDIN in April 1861 proposed an emulsion, which he called photogene', with collodion or gelatine, and in the same month quite independently CAPTAIN HENRY DIXON took out a patent for a collodion emulsion process in England.

Bolton and Sayce's was a collodion emulsion containing silver bromide instead of iodide, and the formula which appeared over their joint names was improved by Sayce alone and published on 23 September 1864. In further experiments which Sayce published from time to time he recommended flowing a tannin solution over the plate (as in Russell's process), but soon this preservative was also incorporated in the emulsion. All that a photographer had then to do in the preparation of his plate was to pour on a sensitive emulsion–no silver bath, no preservative of any kind being required. Bolton and Sayce's collodio-bromide of silver emulsion revolutionized plate making. At last it was recognized that silver bromide, not iodide, must form the principal part of such emulsions, and the great light-sensitivity of silver bromide was only effective with alkaline development. Though these collodion emulsion dry plates were somewhat slower than the usual wet plate of the time, they were simpler to prepare and also cheaper than the manufactured Norris plates. Nearly ten years later[19] Bolton adapted to this emulsion an improvement which had meanwhile been made in the gelatine dry process by Richard Kennett. When the emulsion was dry, it was cut up into pieces and well washed until all the soluble salts had been removed. The sensitive collodion pellicle could be bought from Bolton direct: sufficient to make a 20-oz. solution cost 16*s*. The commercial production of collodion emulsion dry plates was undertaken by the Liverpool Dry Plate & Photographic Company at Seaforth near Liverpool from early in 1867. (The firm was probably a descendant of the Tannin Dry Plate Company founded in Liverpool three years earlier.)

The various collodion dry-plate processes constitute an important development in the history of photography, and have for this reason been explained in greater detail than their practical application at the time would seem to warrant. At an exhibition arranged by the Edinburgh Photographic Society in 1877, only 105 pictures out of a total of 824 were by the dry or preservative processes; the remaining 719 pictures were still by the old wet collodion method.

GELATINE DRY PLATES

The invention of gelatine emulsion is usually attributed to DR RICHARD LEACH MADDOX, a physician, distinguished microscopist, and one of the many amateurs in photography who are ever ready to experiment. Chronologically another experimenter, W. H. HARRISON, an engineer, was three and a half years earlier than Maddox in publishing the results of a *partial* success with the first gelatino-bromide emulsion dry plate, but though a picture of great intensity very rapidly appeared, the uneven surface of the film made it worthless. Harrison's and Maddox's papers appeared in *The British Journal of Photography*, on 17 January 1868 and on 8 September 1871 respectively, but neither attracted much attention, for gelatine had often been tried as a substitute for collodion. Pl 209

The first suggestion for photography on gelatine had come from NIÉPCE DE SAINT-VICTOR, who mentioned in his communication 'De la photographie sur verre'[20] to the Académie des Sciences on 25 October 1847, 'I have tried the gelatines. They also give pictures with fine detail . . . but they dissolve too easily in water.' In May 1850 ALPHONSE POITEVIN stated in a paper to the Académie that he poured a thin layer of gelatine on to a glass plate, then plunged it into a solution of acetate of silver and when dry exposed the plate to the vapours of iodine, after which it was ready for the camera. The sensitivity of these plates was low, only about a quarter of that of the daguerreotype, and the gelatine was found to swell and even to dissolve in the silver bath.

An amateur in Tavistock, England, described in 1854[21] his method of using gelatine as a substitute for collodion or albumen, claiming an exposure time of only 35 seconds on a bright day, but there were probably disadvantages unknown to us. Another early experimenter was ALEXIS GAUDIN, then editor of *La Lumière*, who, besides devising a collodion emulsion, published as early as April 1861 a process with washed silver iodide gelatine emulsion which was spread on a substratum of albumen, which caused the thin layer of gelatine to adhere satisfactorily to the plate. These plates were developed with a concentrated tannin solution to which a few drops of nitrate of silver were added. They were, however, nearly as slow as albumen plates.[22] THOMAS SUTTON of Jersey, recognizing the importance of Gaudin's gelatine emulsion, suggested gelatino-bromide instead of iodide emulsion,[23] thus coming remarkably close to the ultimate goal; but he did not confirm his theories with experiments. That gelatine/silver bromide emulsion was more than a passing notion of his is confirmed by a paper he wrote ten years later.[24] In this, Sutton wrote prophetically of the photographic tourist of the future, who, dispensing with the paraphernalia of the wet collodion process, would need to take only a bottle of bromide of silver emulsion. With this he would coat his plates at night and without any further bother have dry plates in the morning. 'What a blessing it would be to be independent of collodion, and at the same time not to have to trust to the keeping qualities of dry plates!' And he concluded, 'It may turn out that I have done well in digging up this old process of M. Alexis Gaudin, whose name be exalted as the author of collodion emulsions and photogenes!'

Fulfilment of Sutton's hopes came much sooner than he could have imagined. Two months later Dr Maddox published in the same journal a fragmentary report of his experiments, hurriedly written to oblige his friend the editor. If they failed to attract the attention their importance deserved, this may be partly due to the extreme modesty of Dr Maddox's introduction, which was far from confidence-inspiring.

> A few remarks upon the application of another medium may perhaps not be uninteresting to the readers of the Journal, though little more can be stated than the result of some careless experiments tried at first on an exceedingly dull afternoon. It is not for a moment supposed to be new, for the chances of novelty in photography are small, seeing the legion of ardent workers and the ground already trodden by its devotees. . . . Gelatine, which forms the medium of so many printing processes, and which doubtless is yet to form the base of more, was tried in place of collodion in this manner. . . .[25]

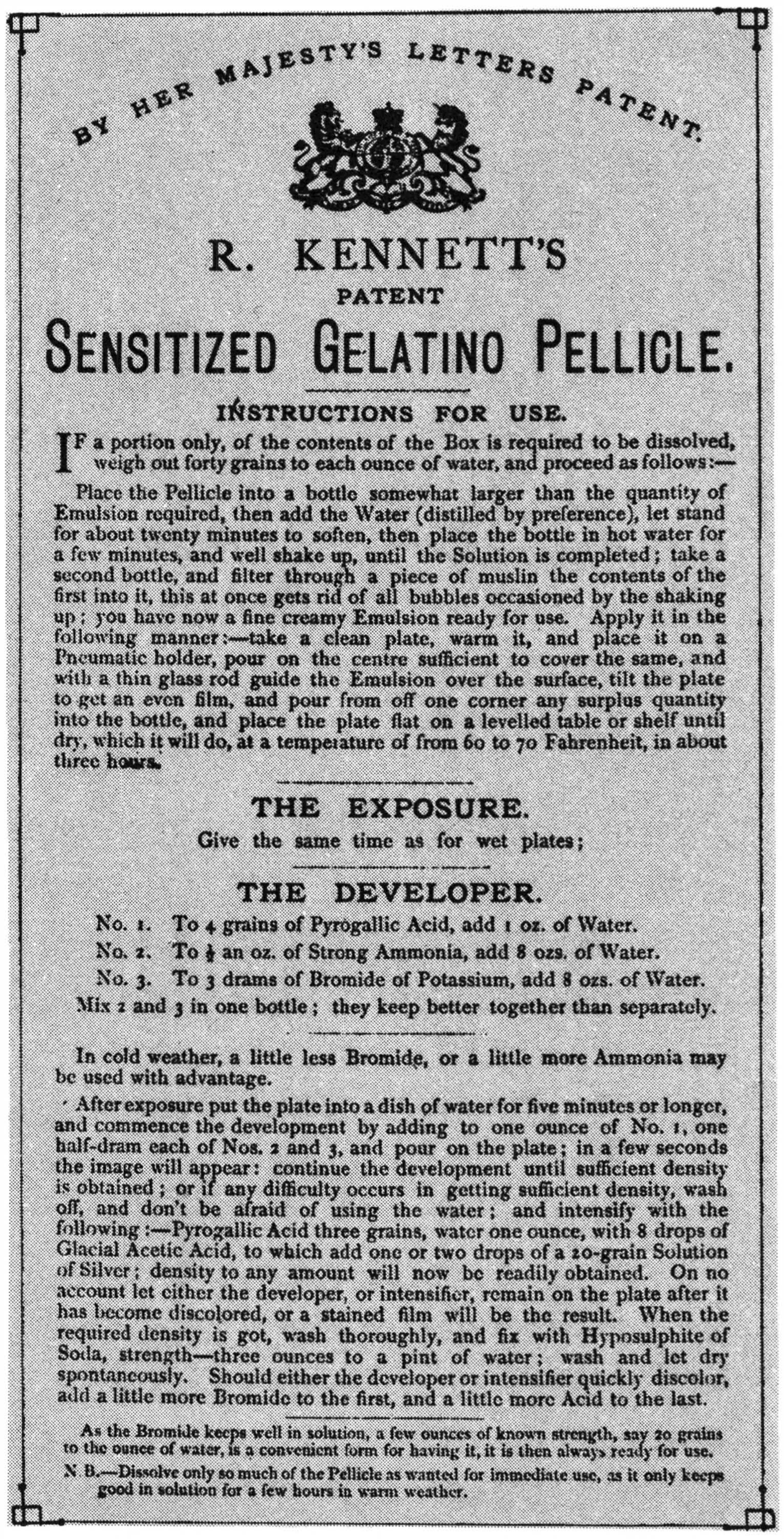
Dr Maddox then described how he formed an emulsion of gelatine containing aqua regia (nitric and hydrochloric acid), cadmium bromide, and silver nitrate; this he coated on glass plates and on paper, testing its sensitivity by printing upon it from existing negatives, and using a solution of pyrogallol containing a trace of nitrate of silver for the development. The exposure for printing these positives on glass plates varied from 30 seconds to a minute and a half in very poor light. Dr Maddox concluded, 'As there will be no chance of my being able to continue these experiments, they are placed in their crude state before the readers of the Journal, and may eventually receive correction and improvement under abler hands. So far as can be judged, the process seems quite worth more carefully conducted experiments.' He omitted to mention his application of the gelatine emulsion to negatives, which created the impression that he had only thought of a positive printing process, but in fact he had sent the editor some gelatine silver bromide negatives, which were seen some ten years later by Dr J. M. Eder, who described them in his *History* as 'small, delicate, completely detailed brown negatives'.

Dr Maddox suffered for over half a century from a painful disease–though he survived to the age of eighty-five–and ill health was the cause of his neglecting to work out his process. It was also in a way the cause of his discovery, for he related that it was largely because collodion fumes were affecting his health that he turned his attention to the use of other substances, including lichen, linseed, quince-seed, rice, tapioca, sago.

The (unwashed) gelatino-bromide emulsion advocated by Dr Maddox had to wait nearly two years for 'correction and improvement under abler hands'. In July 1873 JOHN BURGESS, a London photographer, advertised[26] the first gelatine emulsion for sale enabling anyone 'to prepare dry plates equal in sensitiveness to the best wet plates by simply pouring on the glass an emulsion and allowing it to dry'. Burgess had obviously taken Maddox's hint, but he refrained from publishing his formula and photographers had to wait another three months before an anonymous correspondent gave complete directions for the preparation of a similar emulsion which he described as giving 'collodio-albumen definition with collodio-bromide rapidity'.[27] Meanwhile Burgess's emulsion did not prove a commercial success though it had been tested and was warmly recommended by the editor of *The British Journal of Photography*. 'The method of preparing a plate is extremely simple', he wrote. 'The emulsion, after being slightly warmed, is poured upon the glass and allowed to dry, and–that is all. In exposing, we adhered to the instructions given, viz.: that the exposure should be precisely the same as for a wet collodion plate. On the application of the developer (alkaline pyro) the picture rapidly made its appearance, every detail being visible.'[28] Indeed, the only weak point of the gelatino-bromide emulsion was its liability to decompose in the heat of summer. 'In spite of all the antiseptics I am acquainted with', admitted Burgess, 'it will ferment if the thermometer rises above 70° F. I have therefore determined to confine myself to the making of dry plates which will keep any time.'[29] In accordance with this resolve, the inventor advertised the first ready-made gelatino-bromide dry plates on 29 August 1873, the price being *2s. 6d.* per dozen quarter-plates.

To John Burgess is undoubtedly due the practical introduction of the gelatine dry plate which ushered in a new era of photography and finally dispensed with the necessity for photographic vans, developing tents, and all the other paraphernalia which made the life of the travelling landscape or architectural photographer a burden in the wet-plate period. This needs stressing, for all the honours of the invention were somewhat unjustly accorded to Dr Maddox, who was awarded the gold medal of the International Inventions Exhibition in 1885, the Progress Medal of the Royal Photographic Society in 1901, and a reward of £400 subscribed in 1892 by plate-makers and professional and amateur photographers of many countries.[30] By the time the value of the gelatine plate had at last become officially recognized, the invention was old, and the idea prevailed that Dr Maddox had produced a plate similar to those then in use, though perhaps not quite so good. Yet this was a false impression, and Burgess in self-defence stated that Dr Maddox's plates were 180 times slower than wet collodion.[31] He admitted that Dr Maddox was not to blame for this misconception, 'he laid no claim to having made a great discovery, he simply recorded an abortive experiment'.

Though a great advance on Dr Maddox's, Burgess's emulsion was by no means perfect. It contained soluble crystalline salts which are formed by the interaction of the bromide and silver nitrate, and the necessity for washing these out was independently and simultaneously demonstrated by J. King and J. Johnston.[32] Johnston's method of removing the soluble salts consisted in drying the emulsion, cutting it in pieces, and washing it in water. The idea was not lost on RICHARD KENNETT, an amateur in London, who had been experimenting with gelatine emulsion for some years. He incorporated Johnston's method in his patent of 20 November 1873 for a *dried* emulsion which he called 'pellicle', and marketed this 'patent sensitized gelatino-pellicle' in packets containing sufficient to make 2, 4, or 6 oz. of emulsion. All a photographer had to do was to soak the emulsion in water, dissolve it by heat, and pour it on the glass plate. Some months later, on 19 June 1874, Kennett introduced both the pellicle and ready-prepared plates at a meeting of the Photographic Society of London, and though his gelatine plates were not manufactured until March 1876 the simple manipulation of dissolving the pellicle made an instantaneous plate. Kennett did not realize then that the speed of his emulsion was really due to a ripening process, inasmuch as 'the emulsion had to be kept heated for a number of hours, sometimes 24 hours or more, according to the temperature employed to desiccate it'.[33] Fig 49



BY HER MAJESTY'S LETTERS PATENT.

R. KENNETT'S
PATENT
SENSITIZED GELATINO PELLICLE.

INSTRUCTIONS FOR USE.

IF a portion only, of the contents of the Box is required to be dissolved, weigh out forty grains to each ounce of water, and proceed as follows:—

Place the Pellicle into a bottle somewhat larger than the quantity of Emulsion required, then add the Water (distilled by preference), let stand for about twenty minutes to soften, then place the bottle in hot water for a few minutes, and well shake up, until the Solution is completed; take a second bottle, and filter through a piece of muslin the contents of the first into it, this at once gets rid of all bubbles occasioned by the shaking up; you have now a fine creamy Emulsion ready for use. Apply it in the following manner:—take a clean plate, warm it, and place it on a Pneumatic holder, pour on the centre sufficient to cover the same, and with a thin glass rod guide the Emulsion over the surface, tilt the plate to get an even film, and pour from off one corner any surplus quantity into the bottle, and place the plate flat on a levelled table or shelf until dry, which it will do, at a temperature of from 60 to 70 Fahrenheit, in about three hours.

THE EXPOSURE.

Give the same time as for wet plates;

THE DEVELOPER.

No. 1. To 4 grains of Pyrogallic Acid, add 1 oz. of Water.
No. 2. To ½ an oz. of Strong Ammonia, add 8 ozs. of Water.
No. 3. To 3 drams of Bromide of Potassium, add 8 ozs. of Water.
Mix 2 and 3 in one bottle; they keep better together than separately.

In cold weather, a little less Bromide, or a little more Ammonia may be used with advantage.

After exposure put the plate into a dish of water for five minutes or longer, and commence the development by adding to one ounce of No. 1, one half-dram each of Nos. 2 and 3, and pour on the plate; in a few seconds the image will appear: continue the development until sufficient density is obtained; or if any difficulty occurs in getting sufficient density, wash off, and don't be afraid of using the water; and intensify with the following:—Pyrogallic Acid three grains, water one ounce, with 8 drops of Glacial Acetic Acid, to which add one or two drops of a 20-grain Solution of Silver; density to any amount will now be readily obtained. On no account let either the developer, or intensifier, remain on the plate after it has become discolored, or a stained film will be the result. When the required density is got, wash thoroughly, and fix with Hyposulphite of Soda, strength—three ounces to a pint of water; wash and let dry spontaneously. Should either the developer or intensifier quickly discolor, add a little more Bromide to the first, and a little more Acid to the last.

As the Bromide keeps well in solution, a few ounces of known strength, say 20 grains to the ounce of water, is a convenient form for having it, it is then always ready for use.

N. B.—Dissolve only so much of the Pellicle as wanted for immediate use, as it only keeps good in solution for a few hours in warm weather.

Fig 49 Broadsheet of Kennett's 'patent sensitized gelatino-pellicle', c. 1847

> Richard Kennett is now prepared, with his rapid pellicle plates, to photograph interiors of mines, caverns, or any other subject that has hitherto been an impossibility with any other process, wet or dry.[34]

But even such enticing advertisements failed to make the plates a commercial success. By the irony of fate their very rapidity seems to have been the cause of their commercial failure, paradoxical as this may seem at a time when camera enthusiasts were constantly clamouring for faster and better dry plates. The majority of amateur photographers, always readier than professionals to try something new, failed to appreciate the extraordinary sensitivity of Kennett's plates (one of the few exceptions was Charles Bennett, who worked with the plates from 1875) and, being accustomed to manipulate the much slower collodion dry plates, over-exposed them. In addition, the yellow darkroom light commonly used was too bright for these very sensitive plates and caused fogging–a fault for which the plates were blamed. Kennett relates that he found himself in the position of having to reduce the speed of his plates in order to remain in business.

Early in 1876 the Liverpool Dry Plate Co. began the manufacture of Kennett's gelatino-bromide plates, which were faster than their Bolton collodio-bromide dry plates, though the manufacture of the latter was continued for a time. Contrary to expectation, business did not flourish, even after the firm had introduced Charles Bennett's plates in 1878. The reason for the failure of these early gelatine plates to establish themselves lay in the scepticism and conservatism of professional photographers. John Werge relates how he called on the well-known portrait photographers Elliott & Fry in Baker Street in 1878 to persuade them to try Kennett's dry plates, for which he was agent. Mr Fry was incredulous, but when Werge boasted that he would be able to take a portrait on the gelatine plate in a quarter of the time they were giving in the studio with wet collodion plates, he invited him to prove his claim. It was a dull November morning and the operator was giving 1½ minutes for a 10 in. × 8 in. plate. Werge exposed a Kennett plate the same size for 23 seconds, and a perfect negative was the result. Convinced, Fry adopted the new dry plates immediately. But most professionals could not be induced to give them even a trial: they were satisfied with wet collodion.[35]

In 1877 (SIR) JOSEPH WILSON SWAN, whose firm Mawson & Swan in Newcastle supplied a well-known brand of collodion, started making gelatine emulsion; by the latter part of that year the firm was able to supply dry plates which rivalled wet collodion in sensitiveness. Investigating the causes of variation in sensitivity of the plates, Swan found that by cooking the emulsion the sensitivity could be greatly increased. This important discovery of the ripening process by heat remained a manufacturing secret, and credit for its first publication therefore goes to CHARLES BENNETT who had independently arrived at a similar method which he published in *The British Journal of Photography* on 29 March 1878. Bennett, an amateur photographer, had been using Kennett's pellicle since 1875. Exhibiting at a meeting of the South London Photographic Society on 7 March 1878 a number of instantaneous photographs obviously taken with very short exposures, he was urged to publish the process by which he had obtained such marvellous effects. Bennett explained that he made the emulsion with an excess of potassium bromide, heating it at a temperature of 90° F. 'for two, four, or seven days, according to the rapidity required'. Bennett is thus responsible for introducing the so-called ripening process by heat, which opened the way to modern emulsion making and to snapshotting. Since stewing the emulsion for seven days at 90° F. was not only tedious and troublesome, but in summer-time might bring in its wake the decomposition of the gelatine, GEORGE MANSFIELD advocated in August 1879[36] raising the temperature to boiling-point and shortening the cooking time to 10 minutes.[37] The Belgian chemist DR DÉSIRÉ VAN MONCKHOVEN suggested in the same year speeding up the ripening process by the addition of ammonia, but his theories found few adherents in England at the time, and were soon after modified by himself.

It was obvious that emulsion making could not be undertaken in the darkrooms of individual photographers, and had best be carried out by commercial firms on a large scale.

By April 1878, four firms in Great Britain were producing gelatine dry plates: The Liverpool Dry Plate & Photographic Printing Co. (then in London); Mawson & Swan, of Newcastle; Wratten & Wainwright, London; and Samuel Fry & Co., Kingston-on-Thames. By the autumn of the following year their number had grown to fourteen, and several others supplied emulsion in bottles. Production of the famous Ilford plates by the Britannia Works Co. at Ilford, Essex, began in 1879. Within ten years they commanded 'the largest sale of any dry plates in the world'.

In November 1879 J. W. SWAN patented the first automatic machine for coating glass plates with gelatine emulsion, to ensure 'more perfect regularity in the coating, and also greater rapidity than by the methods hitherto employed'. B. J. EDWARDS of London introduced another dry-plate coating machine in 1880, which could coat 1,200 plates per hour, in any size up to 20 in. × 24 in.[38]

The change-over to gelatine, which had begun with Charles Bennett, was now in full swing. Photographers could no longer deny the superiority of dry plates, their good keeping qualities, their simplicity of development, and, above all, their wonderful rapidity, which opened up new fields of photography. Exposures with these dry plates were $\frac{1}{10}$ to $\frac{1}{20}$ of those with wet collodion. A revolution was taking place in photography similar to that caused by the introduction of collodion thirty years earlier. By 1881, the wet plate was more or less superseded for studio and field work (though on account of its extremely fine structure it continues to be used for process-engraving up to the present day). The change-over is clearly shown by statistics concerning the annual exhibitions of the Photographic Society of Great Britain, in October 1880, 1881, and 1882. In 1880 there were 653 photographs from gelatine plates and 518 from collodion. In 1881 there were 1,619 photographs from gelatine plates and only 327 from collodion. In 1882 the revolution was almost complete: of 1,437 photographs, only 21 were from collodion negatives.

Prices charged by the leading firms for gelatine dry plates were:

size in inches	In 1880 *per dozen*	In 1882 *per dozen*	In 1890 *per dozen**
4¼ × 3¼	3 0	2 4	1 0 – 1 6
5 × 4	4 6	3 6	1 7 – 2 3
6½ × 4¾	6 6	5 0	2 3 – 3 6
6½ × 8½	12 0	9 0	4 3 – 6 6
10 × 8	18 0	12 8	7 3 – 10 6
12 × 10	£1 6 6	£1 0 0	10 0 – 16 0

**according to speed rating*

As the evolution of the gelatine dry plate is unfolded step by step in the pages of *The British Journal of Photography*, we realize that its introduction was due entirely to British ingenuity. Its commercial manufacture was for the first few years also almost
Fig 50 exclusively in the hands of British firms, and became a valuable export.

With the dry plate truly instantaneous photography, with exposures of less than a second, can be said to begin, and as the plates were ready-made, photographic technique became so much simplified that 'a person of average intelligence could master it in three lessons'. The Archbishop of York–a keen amateur photographer and President of the Dry Plate Club since its inception in March 1872–wrote, 'With these plates photography becomes almost a child's toy'. It was the beginning of the amateur movement which in the 1890s grew to undreamt of proportions.

ORTHO- AND PANCHROMATIC PLATES

Pl 214 DR HERMANN WILHELM VOGEL announced in December 1873, that in the course of experiments in spectrum photography, he had found that by treating collodion emulsion with certain aniline dyes, the dyed silver bromide particles become sensitive to the colours absorbed by the dye. Vogel's discovery arose from his examination of a box of collodion emulsion plates made by COLONEL A. H. P. STUART-WORTLEY. He found that the yellow-red dye coralline, which Stuart-Wortley had used as a backing to prevent halation, had the effect of giving increased sensivity to green. Vogel's pioneer work in orthochromatism (Greek, ὀρθός, correct; χρῶμα, colour) led a number of other investigators to experiment on similar lines, and Becquerel and Waterhouse not only confirmed Vogel's results but each discovered a new and better colour sensitizer. E. BECQUEREL announced in 1874 that (green) chlorophyll increased

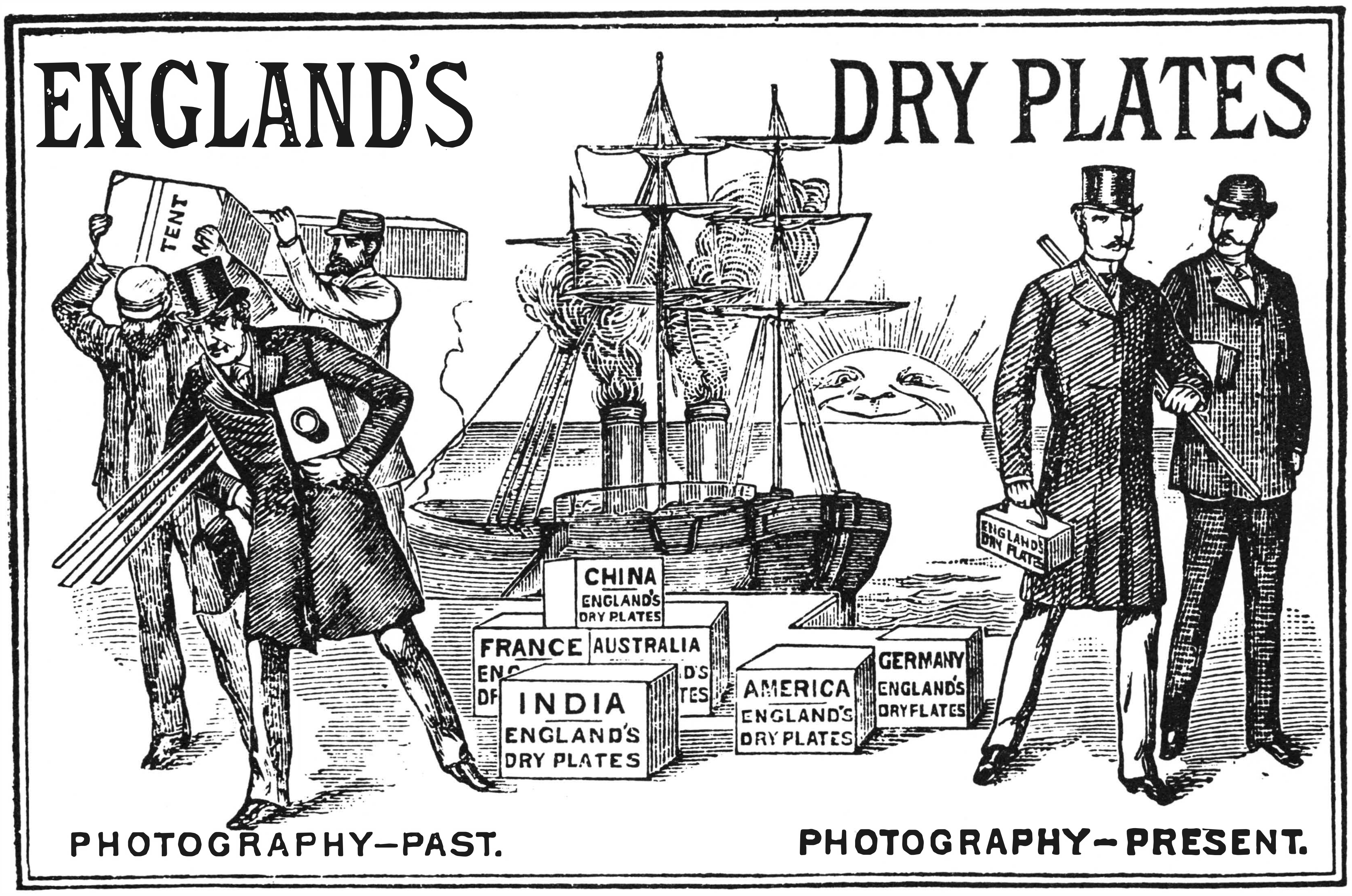

ENGLAND'S DRY PLATES
TENT
CHINA ENGLAND'S DRY PLATES
FRANCE
AUSTRALIA
INDIA ENGLAND'S DRY PLATES
AMERICA ENGLAND'S DRY PLATES
GERMANY ENGLAND'S DRY PLATES
ENGLAND'S DRY PLATES
PHOTOGRAPHY—PAST.
PHOTOGRAPHY—PRESENT.

Fig 50 Advertisement of J. Désiré England's dry plates, 1884

the sensitivity to red, and the following year MAJOR J. WATERHOUSE found the sensitizing effect of (red) eosine in the yellow-green region of the spectrum. Two Frenchmen, JOHN CLAYTON and P. A. ATTOUT (alias Tailfer), were the first to apply eosine successfully to *gelatine* emulsion in 1882, and their eosine plates (which were on the market in the following year) were the first gelatine isochromatic plates. The name isochromatic (from the Greek ἴσος, equal) was suggested by Paul Best, the French statesman and professor at the Sorbonne, and adopted by the inventors of the eosine process.

Vogel had meanwhile experimented with a newly discovered dye, quinoline red, and found it to be an excellent sensitizer for the green part of the spectrum in the *collodion* emulsion, which together with the use of quinoline blue made sensitizing possible for green, yellow, and orange. Vogel's dye mixture 'Azaline', to be added to collodion bromide emulsion, was put on the market by Johann Baptist Obernetter of Munich in 1884, the formula remaining secret.

In the same year DR J. M. EDER perfected orthochromatism with his erythrosine dye which rendered green and yellow more correctly than any other dye, and *gelatine* dry plates of his kind were first manufactured in Vienna in 1884. Waterhouse discovered the extreme sensitiveness to red and infra-red imparted by an ammoniacal solution of alizarine blue, *c.* 1889/90.

Thus Vogel and others transformed the hitherto colour-blind emulsion into one which was more accurately sensitive to most colours–i.e. the so-called iso- or orthochromatic plates.[39] These were, however, still comparatively insensitive to red and over-sensitive to blue. The latter fault could only be corrected by the use of yellow filters. Vogel's successor at the Technische Hochschule, Berlin, PROFESSOR ADOLF MIETHE, and his assistant DR ARTHUR TRAUBE, succeeded in 1903 in extending the sensitivity to yellow and orange, by the addition of ethyl red. This was an important step towards the production of panchromatic emulsion (Greek πᾶν=all)–

i.e. reproducing *all* colours in their correct tone values (except blue, which still had to be filtered). The 'Perchromo' plates introduced by the Munich firm OTTO PERUTZ in 1904 were, however, by no means fully panchromatic. It was only in 1905 and 1906 when pinachrome and pinacyanol were discovered at the German dye works at Höchst am Main by DR ERNST KÖNIG and DR BENNO HOMOLKA respectively, that the sensitivity of the emulsion could be extended to red and infra-red. The first truly panchromatic plates were marketed by WRATTEN & WAINWRIGHT LTD, London, in 1906.

Vogel's discovery was another milestone in the history of photography, for it not only paved the way for correct reproduction of colours in paintings, landscapes, and portraiture, obviating a lot of retouching, but also proved an essential step in colour photography.

28 Permanent photographs

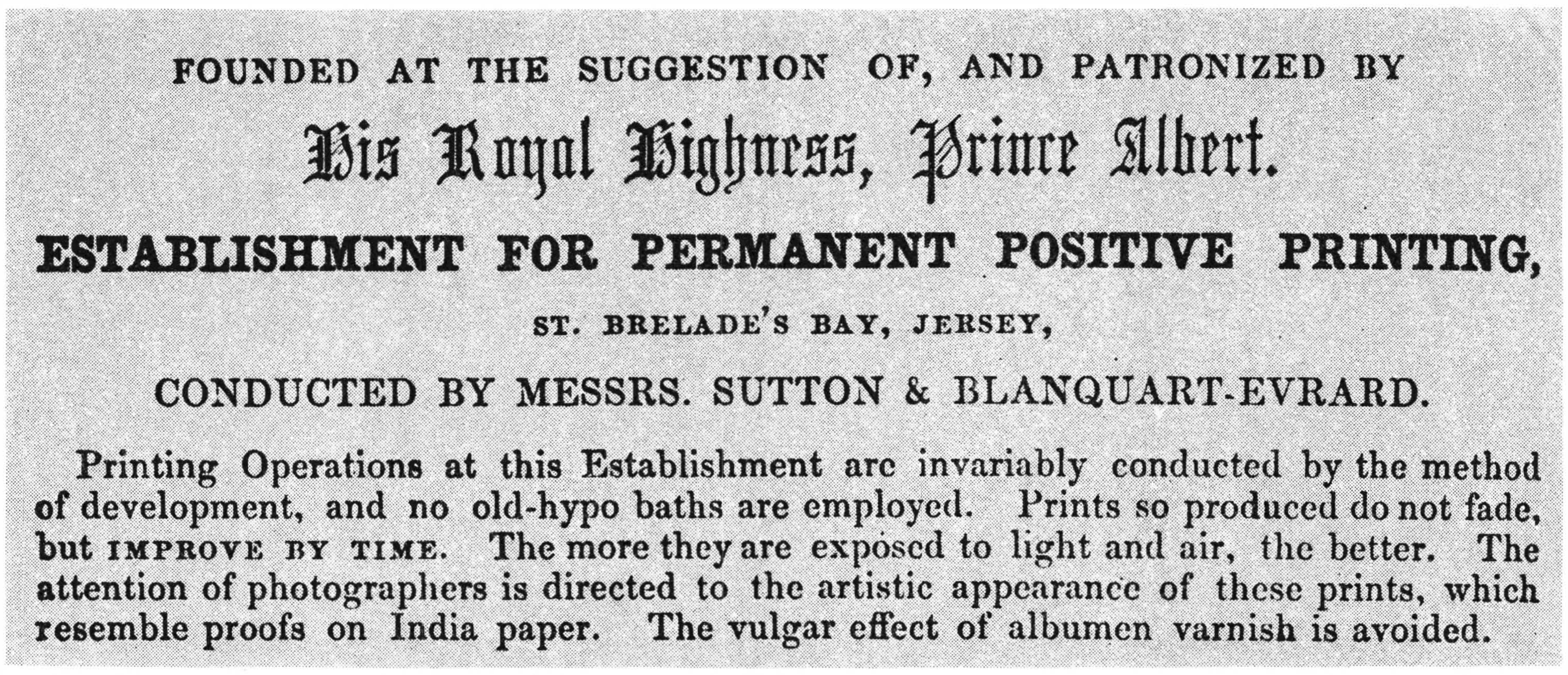
FADING OF SILVER PRINTS

Parallel with the search for a negative process as fast as collodion but dry, went an equally intensive search for a positive printing process which would be permanent. Faith in silver chloride prints (calotype prints) was shaken by the rapid fading of the photographs produced on a large scale only a few years earlier at Talbot's Reading establishment. Fenton's Crimean series issued in 1855–6 by Thomas Agnew of Manchester was the last extensive publication making use of Talbot's plain salted paper. The Crimean photographs (printed from collodion negatives) have in fact preserved their original quality on the whole, but in 1855 there was no means of knowing what their future state would be, and this quandary was common to all photographers. The majority had by now changed over to making their prints on albumen paper, introduced by Blanquart-Evrard in May 1850, but it was soon found that albumen silver prints were almost as liable to deteriorate as the old calotype prints.

Fading was indeed the greatest misfortune that could befall the new art, and the public as well as photographers were justifiably perturbed, for while the purchaser could judge the aesthetic value of a photograph or a photographically-illustrated book[1] he had no means of proving its durability. The seriousness of the problem was indicated by W. Jerome Harrison in 1888: 'It is doubtful whether a single photograph taken before 1855 could be produced today which has not undergone serious, and for the most part fatal, deterioration.'[2] This was too pessimistic.

In an attempt to overcome the difficulty, the Photographic Society of London in the spring of 1855 set up a committee of seven to investigate the reasons for fading and to ascertain how it could be avoided. Prince Albert, a keen collector of photographs, gave £50 towards the expenses of the inquiry. He also sent his private secretary, Dr Becker, to Lille,[3] for, the prints made at the Lille establishment having proved permanent thus far, the Prince Consort hoped to buy for the benefit of the photographic world Blanquart-Evrard's printing method (described in chapter 15). The French photographer did not wish to reveal his secret, however, and Prince Albert turned to Thomas Sutton of Jersey, who had just published a pamphlet on a method of printing which he claimed to be permanent.[4] This was closely similar to Blanquart-Evrard's, and the Prince encouraged him to open a printing establishment, promising his patronage.

THOMAS SUTTON, a well-known writer on photography,[5] knew Blanquart-Evrard, who had made the prints for his album *Souvenirs de Jersey* (1854). Though



FOUNDED AT THE SUGGESTION OF, AND PATRONIZED BY

His Royal Highness, Prince Albert.

ESTABLISHMENT FOR PERMANENT POSITIVE PRINTING,

ST. BRELADE'S BAY, JERSEY,

CONDUCTED BY MESSRS. SUTTON & BLANQUART-EVRARD.

Printing Operations at this Establishment are invariably conducted by the method of development, and no old-hypo baths are employed. Prints so produced do not fade, but IMPROVE BY TIME. The more they are exposed to light and air, the better. The attention of photographers is directed to the artistic appearance of these prints, which resemble proofs on India paper. The vulgar effect of albumen varnish is avoided.

Fig 51 Advertisement of Thomas Sutton's and Blanquart-Evrard's printing establishment at St Brelade's Bay, Jersey, 1855

Blanquart-Evrard had previously refused Sutton's request to sell the secret to him, he had recently given up the Lille establishment and was now persuaded to join him
Fig 51 in the management of a new printing firm at St Brelade's Bay, Jersey. This was started under the patronage of Prince Albert in the late autumn of 1855, and their first joint publication–a collection of photographs entitled *The Amateur's Photographic Album*–appeared in December. We have been unable to ascertain how many parts were issued, but the publication went on for at least a year at irregular intervals, each part containing three to four photographs and costing 6*s*.

In January 1856 the partners, whose association lasted for about two years, started a new venture; the *Photographic Notes*, a monthly–later fortnightly–journal, which was edited by Sutton until its last issue in December 1867.

The photographs were printed in Jersey by Blanquart-Evrard's method, which was revealed[6] when neither had any more use for it. Though not permanent in the now accepted sense of being produced without silver salts, the prints withstood rather stringent tests, such as the one which Sir David Brewster carried out. He cut a print in three parts, soaked one in water, exposed the second to daylight, and kept the third in the dark for comparison. After three months no change was found.[7]

When the report of the Fading Committee eventually appeared[8] it gave an excellent analysis of the various causes of fading: imperfect washing of prints, the use of old or insufficiently acid hypo baths containing so much sulphur that it amounted to sulphur toning, the acidity of certain gums used for mounting, moisture and sulphur in the air (particularly in London). They stressed the need for more thorough washing of prints after fixing, for protecting photographs from air and moisture, and, with two dissentients, recommended the toning of albumen prints with chloride of gold. When all was said and done, however, fading remained the ever-present drawback. Even photography's best friend, *The Art Journal*, thought it timely to sound a warning note in 1861: 'If the buyer of those chemical pictures finds by and by that he has a portfolio of "vanishing scenes" or of "fleeting images", he will weary of collecting them, and return to less truthful but more enduring productions.'

Many highly qualified men re-examined the vexing question from time to time, and most came to the conclusion that the fading of albumen prints–provided reasonable care had been taken–was due to the destructive influence on the silver of traces of sulphur contained in the white of egg. It was generally agreed that gold toning preserved the prints, as well as giving them an attractive purplish-brown colour, and that the stronger the toning the greater the permanence–and this is certainly borne out by the photographs which have come down to us. Yet inspection of the work of photographers of reputation shows that in spite of all precautions, some of their pictures have deteriorated although produced under apparently the same conditions as those which have remained unchanged. This uncertainty led inventive minds to direct their attention to the production of permanent photographs by other means, which we shall briefly enumerate in the following pages. A great stimulus in this direction was given by the Duc de Luynes, who in June 1856 offered awards for methods of producing cheap permanent printing methods. The duke, a member of the Institut de France and of the Société Française de Photographie, was an archaeologist, and he was disappointed by the lack of permanence of photographs–the very medium by which he had hoped that records of antiquities, which time was destroying, might be preserved for posterity. He gave 10,000 francs (then £400)–8,000 francs to encourage photomechanical printing, and 2,000 francs for the invention of permanent photographic prints.

PIGMENT PRINTING WITH CHROMIC SALTS

One of the most important discoveries in the history of photography was the observation made in the spring of 1839 by MUNGO PONTON that bichromate of potassium[9] spread on paper is light-sensitive. Ponton was trying to make photogenic drawings with chromate of silver when he discovered that 'when paper was immersed in the bichromate of potash alone, it was powerfully and rapidly acted on by the sun's rays. It accordingly occurred to me to try paper so prepared to obtain drawings, though I did not at first see how they were to be fixed. The result exceeded my expectations.' With a suitable object laid upon the paper, those parts exposed to sunlight were hardened while the parts protected by the object could be dissolved away with water, leaving the image of the object white upon an orange ground, and quite permanent. The action of bichromate of potash is thus very similar to that of bitumen of Judea in Nicéphore Niépce's heliography. Pl 215

Ponton communicated his discovery to the Society of Arts for Scotland, of which he was a Vice-President, on 29 May 1839. The full text of his 'Notice of a cheap and simple method of preparing paper for photographic drawing, in which the use of any salt of silver is dispensed with' will be found in *The Edinburgh New Philosophical Journal*, July 1839.[10] The cheapness of the process seems to have appealed most to Ponton, both as a Scot and as Secretary of the Bank of Scotland, for he drew particular attention to the fact that while half-a-crown would buy only ½ oz. of nitrate of silver it would buy a pound of bichromate of potash. Neither he nor his audience could then have been aware of the far-reaching implications of the discovery, which seemed to be merely a variation of Talbot's, rather than the basis for an entirely new approach to making pictures by light. Indeed, Ponton's observation was hardly less important than Wedgwood's, a milestone in the history of photography and photomechanical printing.

When the French physicist EDMOND BECQUEREL experimented with variations of Ponton's process on different kinds of paper in 1840, he established that it was not the bichromate of potash as such which was very light sensitive, but that the size in the paper (starch) greatly increased its sensitivity. That fact was not lost on JOSEPH DIXON of Massachusetts, who in the following year made the first practical–though misguided–application of Ponton's and Becquerel's observations, when he counterfeited dollar notes by coating lithographic stone with bichromated gum. However, nothing was heard of this until the inventor was free to tell his story,[11] and credit for first publishing a photographic application with bichromate and gelatine must go to FOX TALBOT, who applied these substances in his process of photoglyphic engraving, patented in October 1852. Talbot went an important step farther than Ponton. While the latter had recorded the fact that bichromate of potash loses its solubility after exposure to light ('The agency of light not only changes its colour but deprives it of solubility'), Talbot (acting on the indication of Becquerel) found that organic substances such as starch, glue, gum, gelatine, etc., acquire the same property when mixed with bichromate of potash, and this principle became the basis of nearly every pigment printing and photomechanical printing process up to the present day. Whereas Talbot applied this knowledge to photo-etching (discussed in chapter 44), Pl 216 ALPHONSE LOUIS POITEVIN conceived the idea of applying it to the production of permanent prints, as well as to photolithography.

A chemist and civil engineer, Poitevin took up the study of photography soon after the publication of the daguerreotype process. Recognizing that its great defect lay in the impossibility of multiplication, he tried by various methods, such as electrotyping, to overcome this difficulty. Later he devoted his time to photomechanical printing and permanent prints, and by 1855 was well on the way to achieving his ambition by several different methods, which made him the founder of the carbon process and of collotype. For pigment printing (carbon process) he received the Duc de Luynes's gold medal in 1859 and 2,000 francs in 1862. For the best photomechanical printing process with fatty ink (collotype) he was awarded the second part of the duke's prize, 8,000 francs, in 1867. Poitevin also received another money award, 12,000 francs, from the Société d'Encouragement des Arts.

The Carbon Process. In the carbon process, patented in August 1855, Poitevin mixed powdered carbon–one of the most unalterable substances in nature–in bichromated gelatine (or gum or other similar substance), spread it on paper, exposed it under a negative, and, after washing, there remained a picture formed by the pigment contained in the insoluble parts of the gelatine, the thickness varying according to the density of the different parts of the negative. Though perfectly satisfactory for reproducing line drawings, in the case of photographs from nature an imperfect copy was obtained, possessing only deep blacks and masses of white, without half-tone. Nevertheless, Poitevin had stated the basic principles and may be regarded as the father of pigment printing. The question of half-tone was only an improvement depending on manipulation.

In 1860 Poitevin invented another carbon process based on totally different principles from the first. He made use of a curious chemical reaction which he had noted, namely, the hygroscopic property given by light to a coating of perchloride of iron and tartaric acid. If such a coating was exposed through a negative, powdered carbon (or other permanent pigment) then brushed on it adhered to those parts which had become sticky by exposure to light, in proportion to the action of light and consequent degree of stickiness. The image was then covered with a layer of collodion and soaked in water, when it detached from the unpolished glass on which it had been formed and was transferred to a sheet of gelatinized paper.[12] This carbon process, patented on 28 June 1860, gave excellent half-tone, and the Parisian portrait photographer Pierre Petit used it for his *Album Contemporain*.

The aim of the many experimenters who tried to perfect Poitevin's first carbon process of 1855 was to obtain the various gradations of half-tone. JOHN POUNCY, a photographer in Dorchester, appears to have been the first actually to produce carbon prints (in gum) from photographic negatives. He showed a number of prints produced by himself and his assistant W. Portbury to the Photographic Society of

London in April 1858, but they were criticized for lack of half-tone. Though Pouncy refused to divulge his mode of working, it was known to be covered by Poitevin's English patent and he advisedly refrained from completing his own specification. The following year he was awarded a silver medal in the Duc de Luynes's competition, for excellence of manipulation.

In July 1858 the ABBÉ LABORDE, a physicist, correctly analysed the cause of the destruction of half-tones: the inability to wash away the unaltered gelatine because it was at the *back* of the image. This marked the beginning of a new stage, but it was still many years before the problem was solved.

C. J. BURNETT (November 1858) and WILLIAM BLAIR (January 1859) proposed that the pigmented gelatine should be exposed through the *back* of the paper, but while this was correct in theory, in practice the grain of the paper caused lack of sharpness.

The next advance was made by ADOLPHE FARGIER, whose method (English patent, 18 April 1861) consisted in pouring on the exposed bichromated gelatine a layer of collodion; when immersed in hot water the collodion with the gelatine came off the glass base, the soluble gelatine melted, and the insoluble parts of the gelatine formed the image on the collodion. This film was then transferred to a sheet of gelatinized paper and the collodion dissolved by ether. The results gave exceedingly fine gradation, but the manipulation of the floating film was fraught with great difficulties, as can readily be imagined.

Pl 272 It was not until five years later, when (SIR) JOSEPH WILSON SWAN, F.R.S., introduced a ready-made carbon tissue, that carbon printing became really practicable. This carbon tissue consisted of a film of gelatine, in which finely powdered carbon was incorporated, spread on paper. The tissue was a commercial article manufactured by Mawson & Swan in Newcastle-on-Tyne, and could be supplied in three grades for negatives of different contrast, and in three colours–black, sepia, and purple-brown–the variations in colour being achieved by adding other permanent pigments besides carbon. The tissue was sensitized by the photographer with a solution of bichromate of potash and, when dry, exposed under a negative. As the carbon tissue was dark all over–the colour corresponding to the deepest tone that could be obtained in the picture–no visible image was produced by light and consequently the exposure in the printing-frame had to be gauged by an actinometer devised by Swan. The face of the carbon tissue was then attached by rubber solution to a temporary paper support and soaked in hot water, when the original backing paper of the carbon tissue could be detached, and the soluble gelatine was dissolved. The insoluble gelatine image remaining on the temporary support was then dried, and as the picture was laterally reversed, it had to be transferred a second time to its final support. The face of the dried print was coated with a solution of gelatine and glycerine, and it was laid on wet paper, and passed through a rolling press. When quite dry, the temporary support which still covered the picture was gently peeled off after the rubber solution had been dissolved with benzole. The picture was in relief, the gradations of the negative being represented by corresponding degrees of thickness in the coloured gelatine.

Swan, who had been experimenting with pigment printing from the moment Poitevin's English patent lapsed in December 1858 through failure to pay the renewal fee,[13] patented his method on 29 February 1864. Wishing to perfect the process, he did not introduce it commercially until two years later.[14] The first large edition which he made was produced at his factory at Newcastle-on-Tyne in June 1866. It was a reproduction of D. O. Hill's painting of the formation of the Free Church of Scotland in 1843, which had just been completed, and photographed by Thomas

Annan. Three different sizes of carbon prints were made, each in an edition of 1,000 copies, the largest size being 48 in. × 21¼ in.

The same year Swan sold the rights for Scotland to T. & R. ANNAN of Lenzie, near Glasgow; for Germany to HANFSTAENGL of Munich; and for France and Belgium to ADOLPHE BRAUN of Dornach (Alsace). All three firms became world-renowned for their carbon prints. Braun & Cie invested over £16,000 in the plant, which was installed under Swan's supervision, and within twelve months this firm–which became particularly famous for facsimiles of Old Master drawings, made by incorporating red chalk, graphite, and other artist's pigments in the gelatine–had an output of 1,500 prints daily.[15] The English patent rights were acquired by the AUTOTYPE PRINTING & PUBLISHING CO. in London, in January 1868.

The licence fee for professional photographers was £10 a year, but as the manipulation was somewhat complicated, most photographers preferred to avail themselves of the printing service provided by the Autotype Co. Charges ranged from 1*s.* 6*d.* for a whole-plate print, to 3*s.* 6*d.* for a 15 in. × 12 in. print.

Both the carbon tissue and the first transfer paper were a commercial article in many countries, and a large number of manuals in English, French, and German followed the first in 1867, by George Wharton Simpson.

Further important simplifications in manipulation were introduced by J. R. Johnson (1869) and J. R. Sawyer (1874), both directors of the Autotype Co., and carbon printing remained in favour well into the present century.

Photomezzotint. Apart from undertaking carbon printing for photographers and publishers, the Autotype Co. themselves published facsimiles of drawings, engravings, and reproductions of famous paintings. In spite of the name, there was nothing automatic about the process, every print being made by hand. Swan did, however, also patent a mechanical form of carbon printing in July 1865–photomezzotint. A carbon print was electrotyped to form a copper mould in which coloured gelatine reliefs were cast. This was very similar to Walter Woodbury's mechanical printing method, and for this reason Woodbury offered Swan half his patent as an independent inventor, suggesting that they should form a partnership to exploit both inventions. The partnership was not concluded, but by a curious twist of fortune both processes were in fact later acquired by the Photo Relief Company and still later, by the Woodbury Permanent Photographic Printing Co.

Swan was a brilliant and prolific inventor. Though his international fame rests on the incandescent electric light bulb, he was a pioneer in a number of photographic fields throughout the evolution of photography in the nineteenth century–from the manufacture of collodion to gelatine dry plates, bromide paper, nitro-cellulose films, automatic plate-coating machines, and half-tone screens. The carbon process was only the first of over sixty patents. 'There are no inventions without a pedigree', Swan once remarked, and it is fitting that his first attempts in photography at the early age of eleven or twelve were made with Mungo Ponton's bichromate process.

Seven months after Swan had patented his carbon process, WALTER BENTLEY WOODBURY took out a patent (23 September 1864) for photo relief printing, which produced very similar permanent photographs.

Woodburytype. Woodburytype falls, strictly speaking, into the category of photomechanical printing; but being far more akin to carbon printing than to any other process it seems to fit more naturally into this chapter. Unlike most other photomechanical printing processes, Woodburytypes had true continuous half-tones and to the untrained eye are indistinguishable from actual photographs–as are carbon prints. Like them, they are mounted and not printed direct on the page, as are prints produced by other photomechanical means. Not being hand-made like carbon prints, Woodburytypes were considerably cheaper and were therefore largely used for book illustration from about 1875 to the end of the century. Swan's carbon prints, on the other hand, could be made in much larger sizes (up to 52 in. × 44 in.),[16] and were therefore preferred for art reproductions of paintings to hang on the wall.

Woodbury's process underwent several improvements subsequent to the original patent. In its final form, a hardened colourless 'gelatine relief' (i.e. a carbon print minus the carbon) was impressed upon a block of lead under enormous hydraulic pressure–an idea doubtless taken from Auer's 'nature printing'. The intaglio mould thus produced was placed in a hand-press, and warm pigmented gelatine poured on. A sheet of paper was spread over this, the press closed, and the excess gelatine squeezed out. When set, the gelatine impression adhered firmly to the paper, and only required hardening in an alum bath. The resulting picture was similar in appearance to a Swan carbon print, and consisted of coloured gelatine in relief, the thickest parts being the darkest.

Woodbury claimed that 600 to 800 impressions could be obtained from each metal mould, and about twenty moulds made from one gelatine relief–that is, at least 12,000 impressions could be obtained from one relief.[17] In practice, however, it was found that only five or six metal moulds could be made from one gelatine relief.[18] The prints could be made at the rate of 120 an hour.[19]

In 1867 Goupil & Co. of Paris acquired for 150,000 francs (then £6,000) the Woodburytype patent rights for France, where the process was introduced as 'Photoglyptie'. In 1870 the American rights were acquired by John Carbutt of Philadelphia.

The British rights were bought by Disdéri & Co. early in 1868, and a French capitalist was said to have financed the new venture to the amount of £40,000. Disdéri was managing director of the company, which was established at one of his London portrait establishments, at Hereford Square, South Kensington. For the first six months the firm seemed to flourish, but then Disdéri suddenly disappeared and the Company went into liquidation. No satisfactory explanation could be given as to the whereabouts of the money.[20] In January 1869 the patent rights and the premises were taken over by the Photo Relief Company, but by an oversight the patent was not renewed in 1872.[21] The process did not, however, become public property as one would expect; it was held to be covered by Swan's photomezzotint patent which the company had also acquired.

Each number of a new monthly art journal which began publication in 1871 or 1872 under the title *The Picture Gallery of British Art* was illustrated with four Woodburytypes of celebrated paintings by British artists. Another monthly magazine, *The Theatre*, had two Woodburytype photographs of famous stage personalities from its first number in August 1878 until it ceased publication in the late nineties. These prints were made by the Woodbury Permanent Photographic Printing Co., which took the process over from the Photo Relief Co.,[22] and eight printers each looking after seven hand-presses arranged around a revolving table were able to produce 30,000 *cartes* in a day.[23] In 1891 a final improvement was made which consisted in transferring the trimmed Woodburytype onto the page and peeling off the paper on which it had been made. The coloured gelatine relief left on the page is so extraordinarily thin that it looks exactly as if it were printed direct on the page. This modification was given the misleading name 'Woodburygravure'.

Stannotype. Owing to the considerable expense of the plant necessary for Woodburytype printing, it remained confined to a few big firms. To enable photographers to produce permanent prints themselves, Woodbury devised a simplified process called Stannotype (Latin *stannum*, tin) which dispensed with the costly hydraulic press (English patent, September 1879). A gelatine relief was made in the usual way, except that a diapositive was copied instead of a negative, so as to produce a reversed relief. This was faced with tinfoil and formed a mould from which pigmented gelatine pictures could be cast in exactly the same way as with the lead mould in the Woodburytype. It was claimed that 400 to 500 impressions could be produced from each Stannotype mould, but although the materials used were inexpensive and the process simple, it did not win favour. A small company was set up in London, but the Stannotype did not meet with its deserved success.

Woodbury was a prolific inventor. Between 1863 and 1885 he took out twenty patents for a great variety of inventions, besides photomechanical printing. Some relate to improvements in optical lanterns, stereoscopes, actinometers, balloon photography, and photographic apparatus, others to kaleidoscopes, barometers, and hygrometers. There was even one for musical railway signals. Like most other inventors Woodbury spent all his money on experiments, and a fund had to be raised in 1885 to assist him and his family. As a youth, he left his native Manchester for Australia, but finding no fortune in the gold-fields he established himself as a photographer in Batavia, returning to settle in London with his Javanese wife in 1863. The remaining twenty-two years of his life were devoted to invention.

CERAMIC PHOTOGRAPHY

Another way of achieving permanence was to print or transfer the photographic image onto less impure and less perishable materials than paper, such as enamel, porcelain, and opal glass. Ceramic photography was practised from two motives: apart from the desire for permanence, the public still hankered after miniatures.

Photographs on porcelain. The earliest suggestions for photographs on porcelain came from FOX TALBOT and THOMAS MALONE, who took out a joint patent in December 1849. Unglazed porcelain plates were to be coated with a substratum of albumen and then with the usual calotype sensitive coating, on which a calotype negative was to be printed. The process was, however, never worked.[24]

The first to recognize the necessity of burning-in the image in a kiln to fix it permanently to the porcelain or enamel were two French photographers, BULOT and CATTIN, whose method of 'fixing, vitrifying, and colouring photographic images taken by the collodion process [which had been transferred] upon enamel, metal, stone, porcelain, glass, china, and all kinds of earthenware' was patented in England on 13 December 1854. The pictures were to be baked in a furnace after they had been coloured, if so desired.

The prime mover in Britain in favour of photographs on porcelain, glass, and similar materials was an amateur photographer, C. J. BURNETT of Edinburgh. Burnett had been engaged from 1855 in extensive experimentation to make paper photographs of more stable substances than silver salts, such as uranium and platinum, and he also suggested burnt-in photographs on porcelain and glass, having black, brown, or other tints after being fired. Knowing that colours change in the furnace, he urged photographers to study the materials used by decorators of porcelain.[25] Burnett's pamphlet *Photography in Colours* (1857) was not concerned with colour photography, but with the production of various tints in burnt-in photographs by ceramic dyes. He himself never actually produced burnt-in photographs, but his researches gave great stimulus to other experimenters on similar lines.

Though the majority of porcelain and opal glass photographs were not burnt-in but made by the ordinary collodion or the collodio-chloride of silver process, they gave satisfactory permanence when coated with copal varnish. These, as well as portraits in which the metallic image had been burnt-in, or to which a Swan carbon print had been transferred, were produced by many photographers and remained in vogue until the early years of this century. Indeed, on account of their permanence, burnt-in porcelain photographs became a common feature on tombstones, for which purpose they are still used in country districts on the Continent.

Burnt-in photographs on glass. JAMES A. FORREST, a founder member of the Liverpool Photographic Society, in 1857 used as a base opal glass finely ground on one side and coated with sensitized collodion on which he printed a photograph by superposition of an ordinary negative. The collodion adhered firmly to the roughened surface of the glass, and after fixing, washing, and drying, the picture was coated with flux and fired in a furnace. The picture was permanent, but of an unattractive yellowish tint owing to the change of colour of the silver in firing.[26]

F. JOUBERT, a well-known French engraver living in London, took out a patent in January 1860 for a method of coating glass with ammonium bichromate, albumen, and honey; when dry, a picture was printed on it from a diapositive. The image was brought out by brushing over with powdered enamel colour, which stuck only to the parts which had not been exposed to light and remained sticky. (This phenomenon was observed by two French photographers, Garnier and Salmon, in 1858 with another substance.) The picture was fixed with alcohol containing a little nitric or acetic acid, and washed in water until nothing remained on the glass but the enamel colour. It was then fired in the kiln. Joubert's glass pictures–landscapes, architecture, portraits, and reproductions of paintings and engravings–could be produced in monochrome, or in polychrome if hand-tinted with ceramic colours which were likewise burnt-in.[27] He produced glass pictures as large as 24 in. × 17½ in., and *The Art Journal* hoped that this latest application of photography would lead to photographic stained glass windows.

Joubert and John Wyard both exhibited photographs on glass, porcelain, and Minton tiles, made by this chromate dusting-on process, to the Society of Arts in 1860. Up to October 1866 Joubert devoted himself chiefly to these large glass transparencies. He then took up the production of enamel portraits (similar to Lafon de Camarsac's) which had so far not been made in England.[28]

Enamel photographs. The most famous of the comparatively few producers of enamel photographs was LAFON DE CAMARSAC, a Paris photographer who brought photographic enamel miniatures to perfection, rivalling the finest ceramic paintings. They were compared with Sèvres porcelain paintings, and earned de Camarsac a gold medal at the International Exhibition in Paris, 1867. It was said that his total output to date was no fewer than 15,000 enamel photographs.[29]

Since the white enamelled copper or porcelain plates were slightly curved, a collodion positive portrait on glass had to be stripped from its support and the film carefully transferred. The enamel or porcelain picture was then put in the furnace, where the heat destroyed the collodion and burnt-in the image formed by the silver. As the silver turned yellow during firing, de Camarsac added gold or platinum chloride to give a darker and more vigorous image. A thin layer of flux fixed the picture to the porcelain or enamel and the result resembled a monochrome painting on porcelain.

For coloured enamel photographs, de Camarsac coated a white enamelled copper plate with a solution of bitumen of Judea and turpentine, with the addition of black resin. He then laid-on the stripped collodion film and exposed. After dissolving the unchanged bitumen, the whole picture was 'coloured' by applying with a fine brush various metallic oxides (enamel powder) and flux. On gently heating the plate, the coating became sticky and the powders adhered to it. The picture was then fired, after which it appeared in its correct colours.

These are the processes as described by de Camarsac to the Académie des Sciences on 11 June 1855,[30] but after the publication of Poitevin's second carbon process (1860) which included a method of making burnt-in enamel pictures, Lafon de Camarsac is said to have changed over to this. Poitevin's process depended on the hygroscopic property of perchloride of iron and tartaric acid, and could be applied to glass, porcelain, or enamelled surfaces, to be burnt-in by substituting metallic oxides for the carbon. The picture was transferred from the glass plate on which it had been formed, in the same way as in the second carbon process (see page 338), onto the surface to be burnt-in.

Several photographers–licensed or unlicensed–employed Poitevin's method. One of his licensees was MATHIEU DEROCHE of Paris (later of Milan) whose firm made coloured enamel portraits until Edwardian times. De Camarsac and Deroche were the best known specialists in this kind of work and executed orders for French and foreign photographers. Their enamel pictures are usually inscribed on the verso: 'Procédé Lafon de Camarsac [or Procédé Deroche]' with the name of the photographer who took the original portrait, the town, the date of the photograph, and the serial number. These miniature-like portraits were fitted into lockets, brooches, pocket watches, or neat little leather cases lined with velvet. Pls 217, 218

Photographs on artificial ivory. In J. E. MAYALL's Ivorytypes (patented October 1855) the photographic image was printed on artificial ivory sensitized with an albumen or collodion coating. The advantage of such 'ivory' miniatures was their cheapness. Being always coloured by an artist, they very much resembled ivory miniatures, but could be produced at one-fifth the cost.

The 'Eburneum' (Latin *ebur*, ivory) pictures introduced by E. BURGESS of Norwich ten years later differed somewhat from ivorytypes. A collodion positive was printed on a glass plate coated with wax. Then a solution of gelatine and zinc oxide was poured on and, after drying, a penknife was run round the edge of the film which at once came off the glass plate, bearing the image.

Mayall's and Burgess's pictures cannot strictly be classed as permanent, since the image was neither burnt-in nor produced in carbon. The same applies to most photographs printed on sensitized silk or linen, introduced by GERARD MOONEN in 1855 and J. LÜTTGENS in 1856 respectively. Exceptions are those printed on sensitized fabric sold by the Platinotype Co. (after about 1880) at prices of 1*s.* 6*d.* to 3*s.* 6*d.* per sq. ft, depending on whether the fabric was linen or silk. Photographs made on these fabrics were in permanent platinum printing.

POSITIVE PRINTING PROCESSES WITH METALLIC SALTS OTHER THAN SILVER

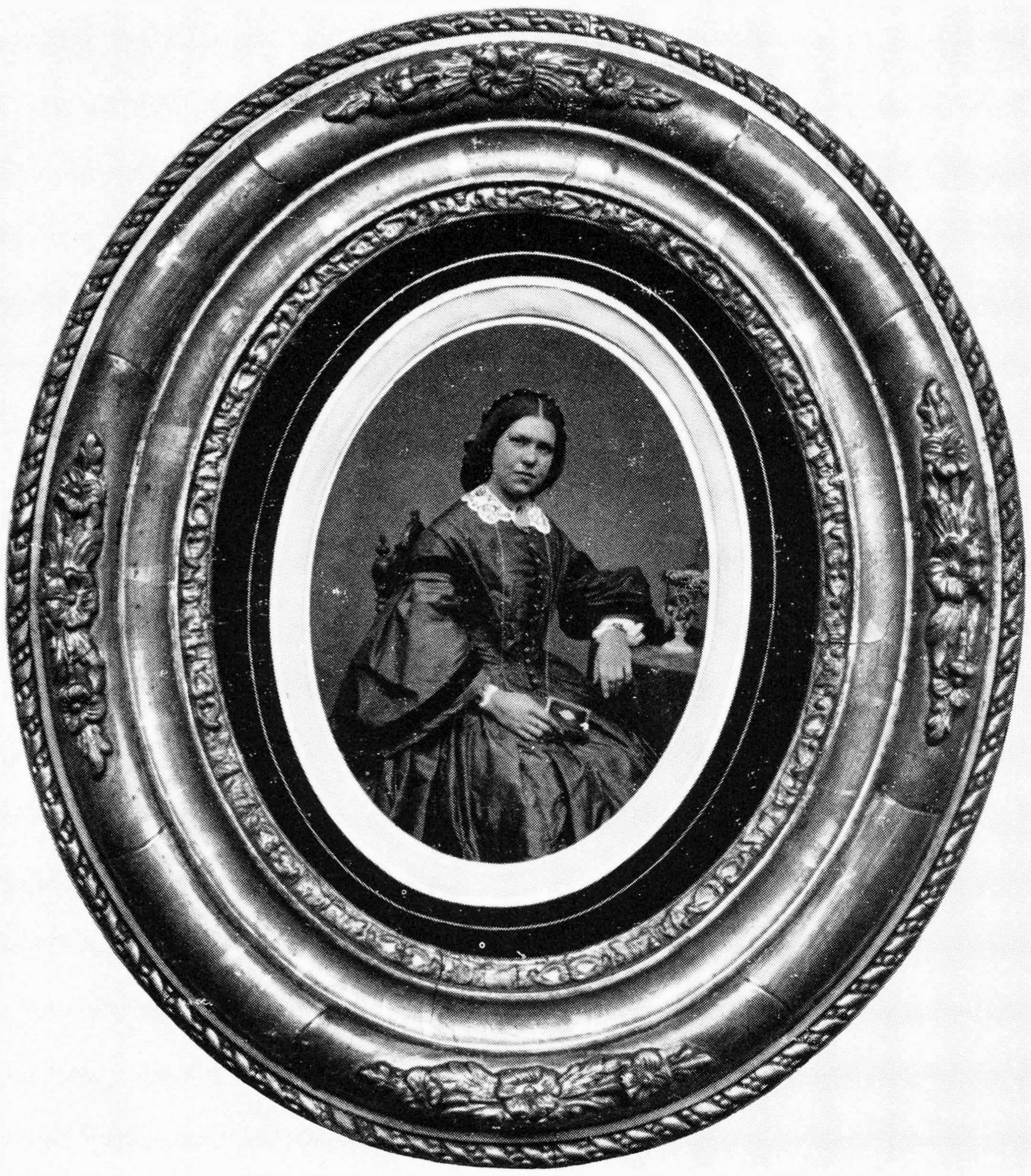
Uranium printing. Seeking a more permanent material than silver, C. J. BURNETT was led to a series of experiments with a large number of other light-sensitive substances, besides suggesting burnt-in photographs, as we have just seen. In 1855 he read a paper to the British Association for the Advancement of Science on a printing process with nitrate of *uranium*, exhibiting the first uranium prints in that year and again in 1856.[31]

Wothlytype. Three years later NIÉPCE DE SAINT-VICTOR published further experiments with uranium printing (in which he was assisted by H. DE LA BLANCHÈRE)[32] but the idea was neglected until J. WOTHLY, a photographer of Aachen, announced a workable process in 1864. At the end of that year the Wothlytype was introduced into England by COLONEL STUART-WORTLEY, who bought the patent rights for Great Britain and formed a company for its commercial introduction. At first the process gave rise to great expectations, for the sensitiveness of the Wothlytype – a paper coated with collodion containing the nitrates of uranium and silver – was superior to that of albumen paper, and the results were claimed to be even and permanent. Amateurs were allowed to practise the process without restriction, while professionals paid a licence fee of 10 guineas for the whole term of the patent. The Wothlytype was a printing-out paper which needed only toning and fixing. The prints failed, however, to fulfil the promise of permanence (on account of the silver nitrate present) and after a couple of years the process was abandoned.

Platinotype. C. J. BURNETT was also the first to exhibit the results of experiments illustrating the use of *platinum* in photographic printing (at the British Association meeting in 1859). Twenty years passed before platinum printing was introduced commercially, for although WILLIAM WILLIS of London invented a method in 1873 (English patent, June 1873), it was not until various improvements had rendered it perfect that he felt ready to put it on the market. The Platinotype Company, established in London in the autumn of 1879, granted licences to amateurs and professionals for the modest sum of 5*s.* and supplied all the necessary materials. Sensitive paper was sold in various grades. Twenty-four sheets of whole-plate size paper or twelve sheets of 12 in. × 10 in. paper cost 6*s.* 6*d.* The platinotype was simple to manipulate and gave permanent prints. The image was partially printed out in one-third of the printing time necessary with albumen paper, and then developed to its full strength. It was, after the calotype, the most beautiful positive printing surface, giving very delicate half-tones. Its soft silver-grey colour was particularly liked by artistic photographers.

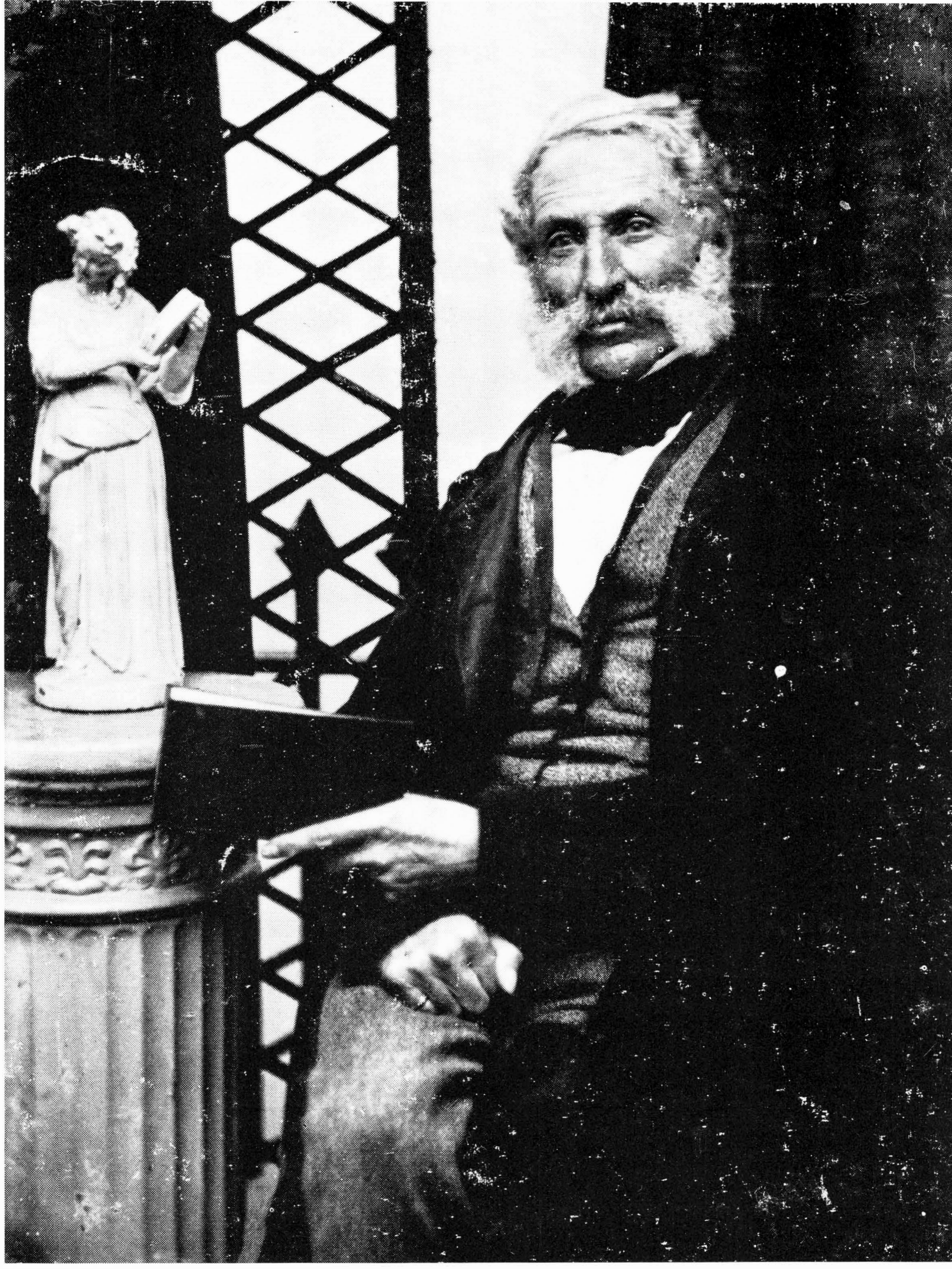
Two Austrian officers, CAPTAIN GIUSEPPE PIZZIGHELLI and BARON VON HÜBL, modified the process so that the image was printed out instead of developed. They popularized this method by their manual (1882) which was translated into English and French. Owing to the constantly rising price of this rare metal, from 25*s.* an ounce in 1878 to £3 in 1891 and still higher in the early years of this century, platinotype paper had eventually to be abandoned.

Plates 97–218



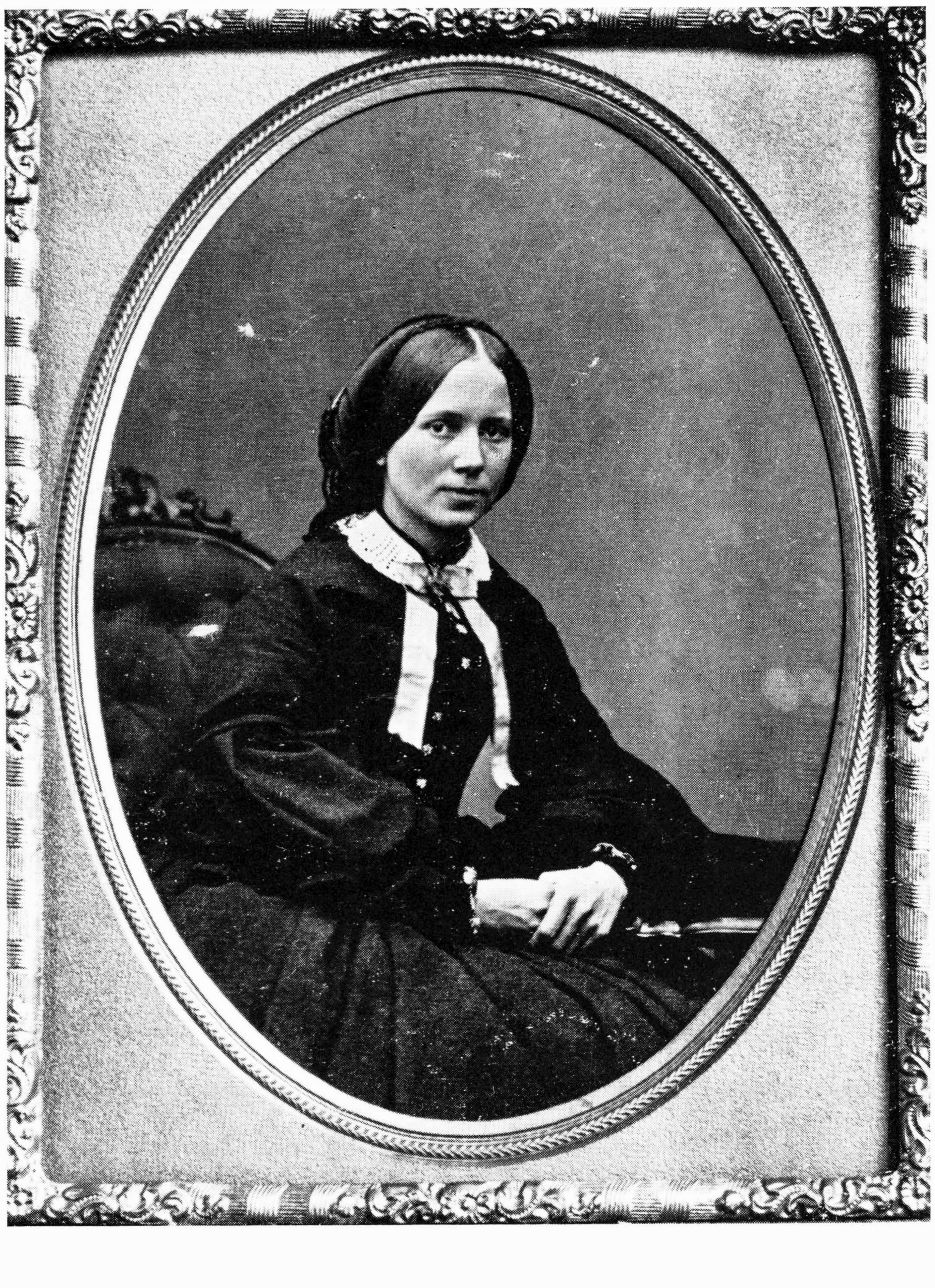
97 Unknown photographer. Coloured ambrotype, $4\frac{3}{4}$ in. × $6\frac{1}{4}$ in., of a lady, *c.* 1858; mounted in contemporary gilt frame, $10\frac{3}{4}$ in. × 12 in.

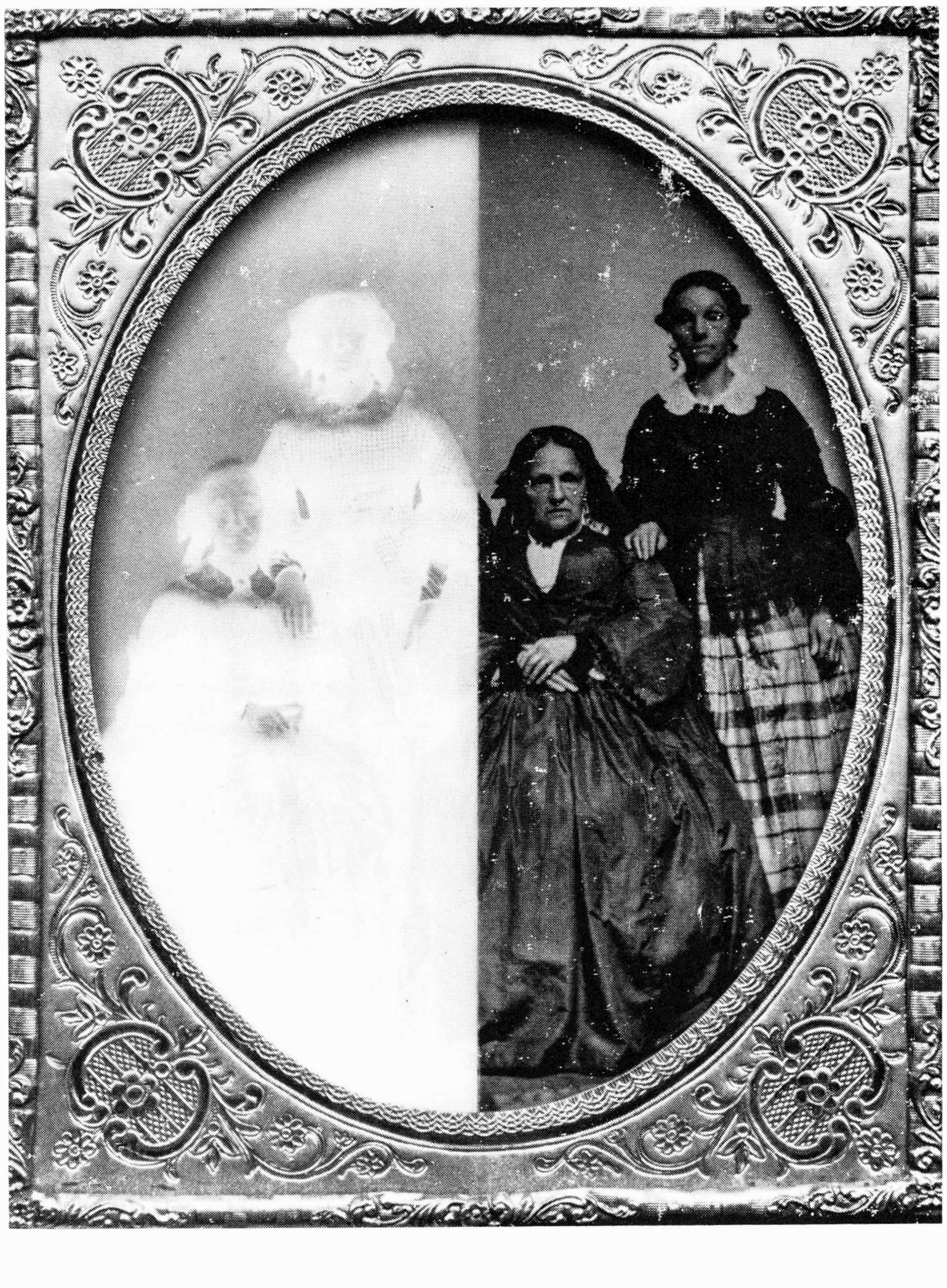
99 Unknown photographer. Ambrotype of a lady, 3 in. × 4 in., *c.* 1858

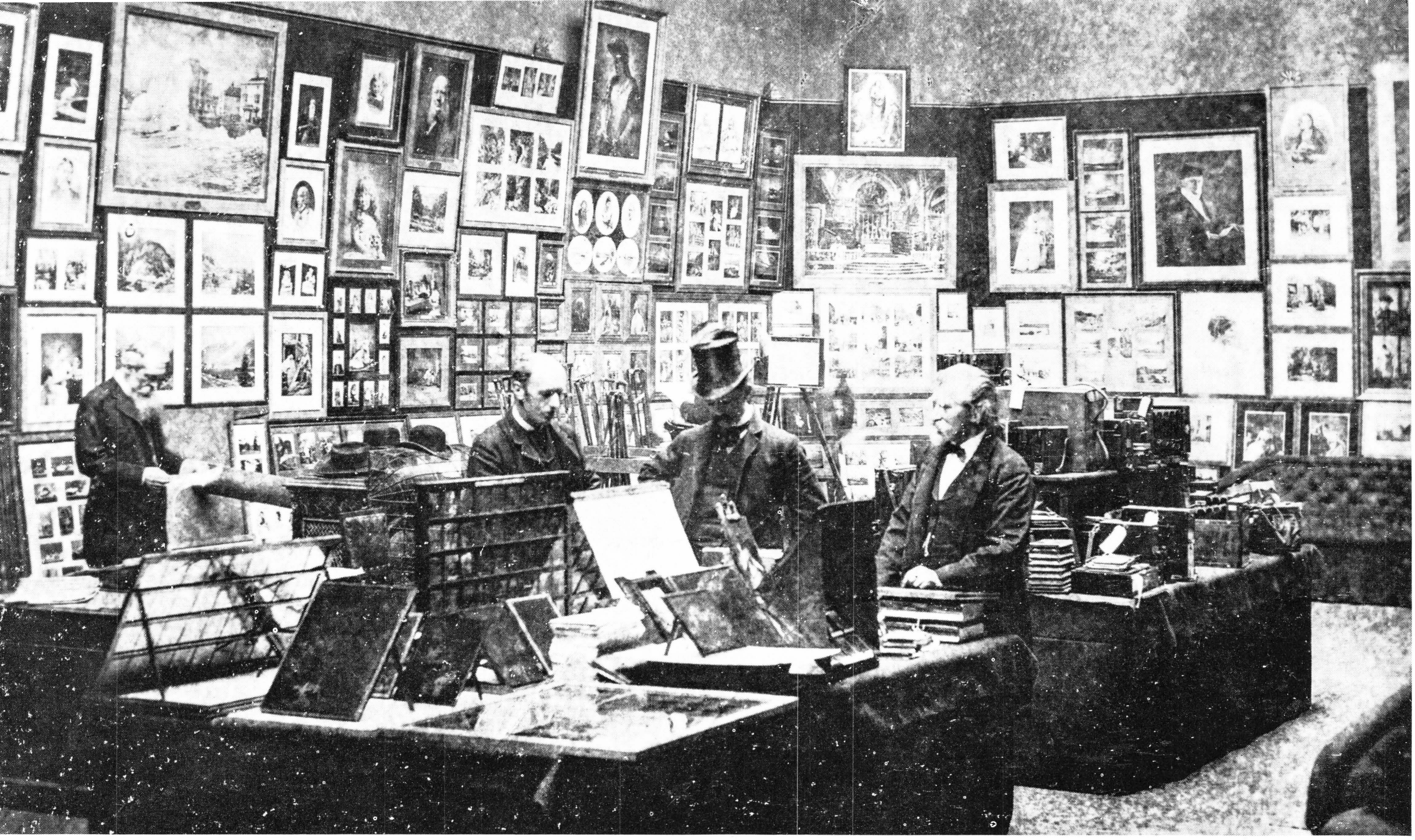


98 Unknown photographer. Ambrotype of an old gentleman, 4 in. × 5 in., *c.* 1867

100 Unknown photographer. Ambrotype, $3\frac{1}{2}$ in. × $4\frac{3}{4}$ in., with half the backing removed to show positive and negative effect, *c.* 1855







101 The Photographic Society's exhibition, 1884. In the picture are seen (left to right): WILLIAM ENGLAND, W. F. DONKIN, SIR W. DE W. ABNEY (President), and EDWARD COCKING (Secretary)

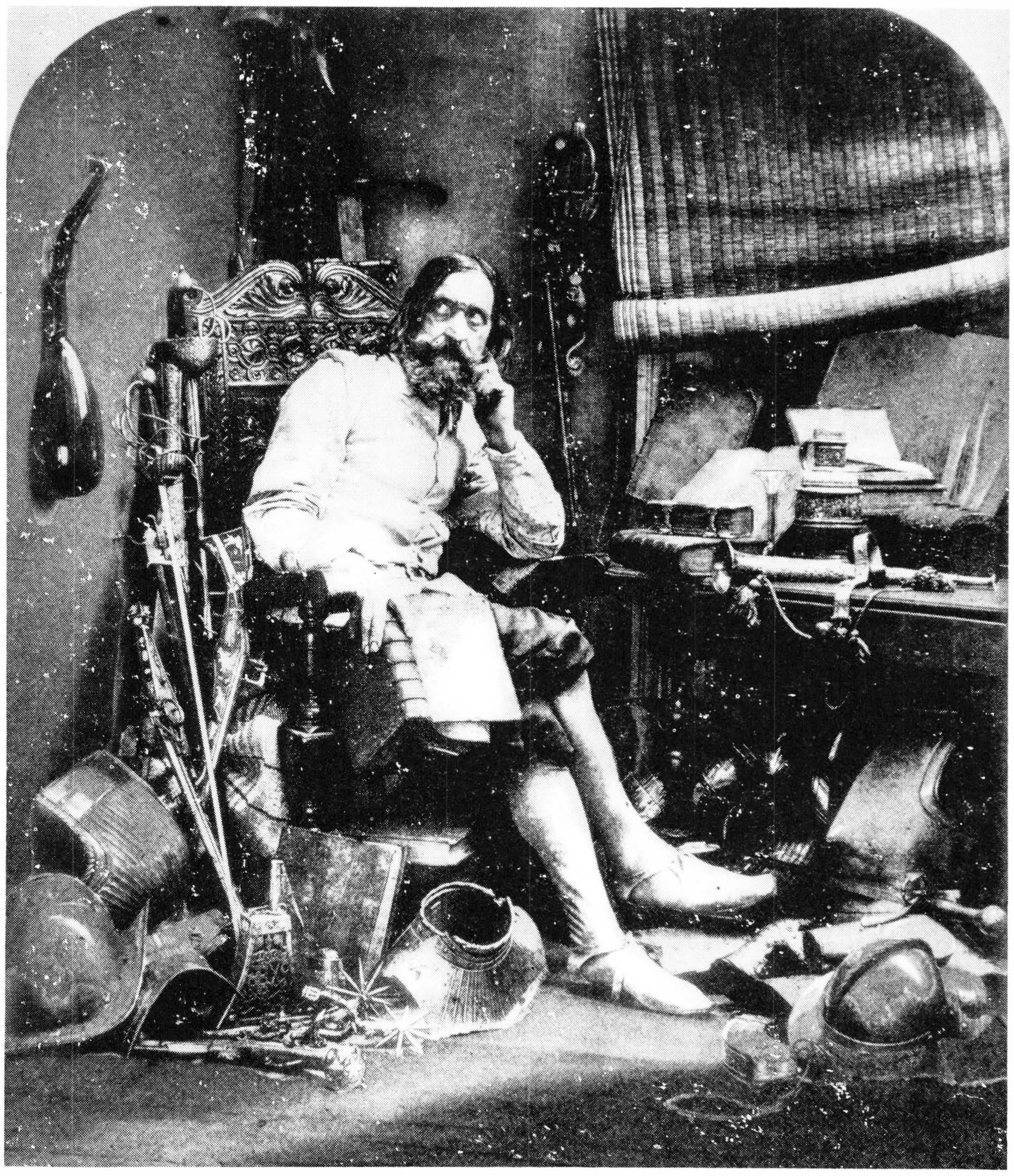
102 WILLIAM LAKE PRICE. 'Don Quixote in his Study', 1855. Print by Pretsch's photogalvanographic process

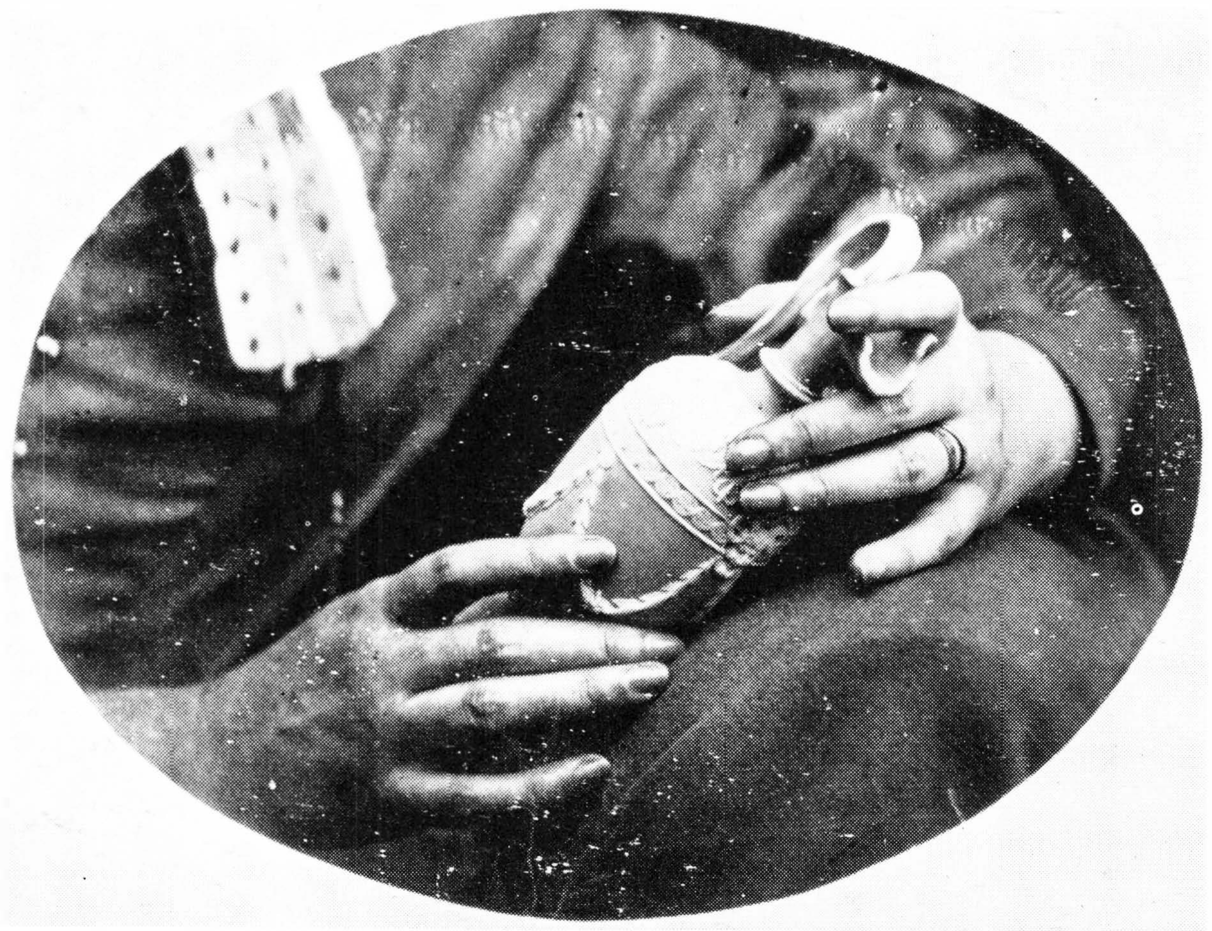
103 O. G. REJLANDER. Hands and vase, 1860

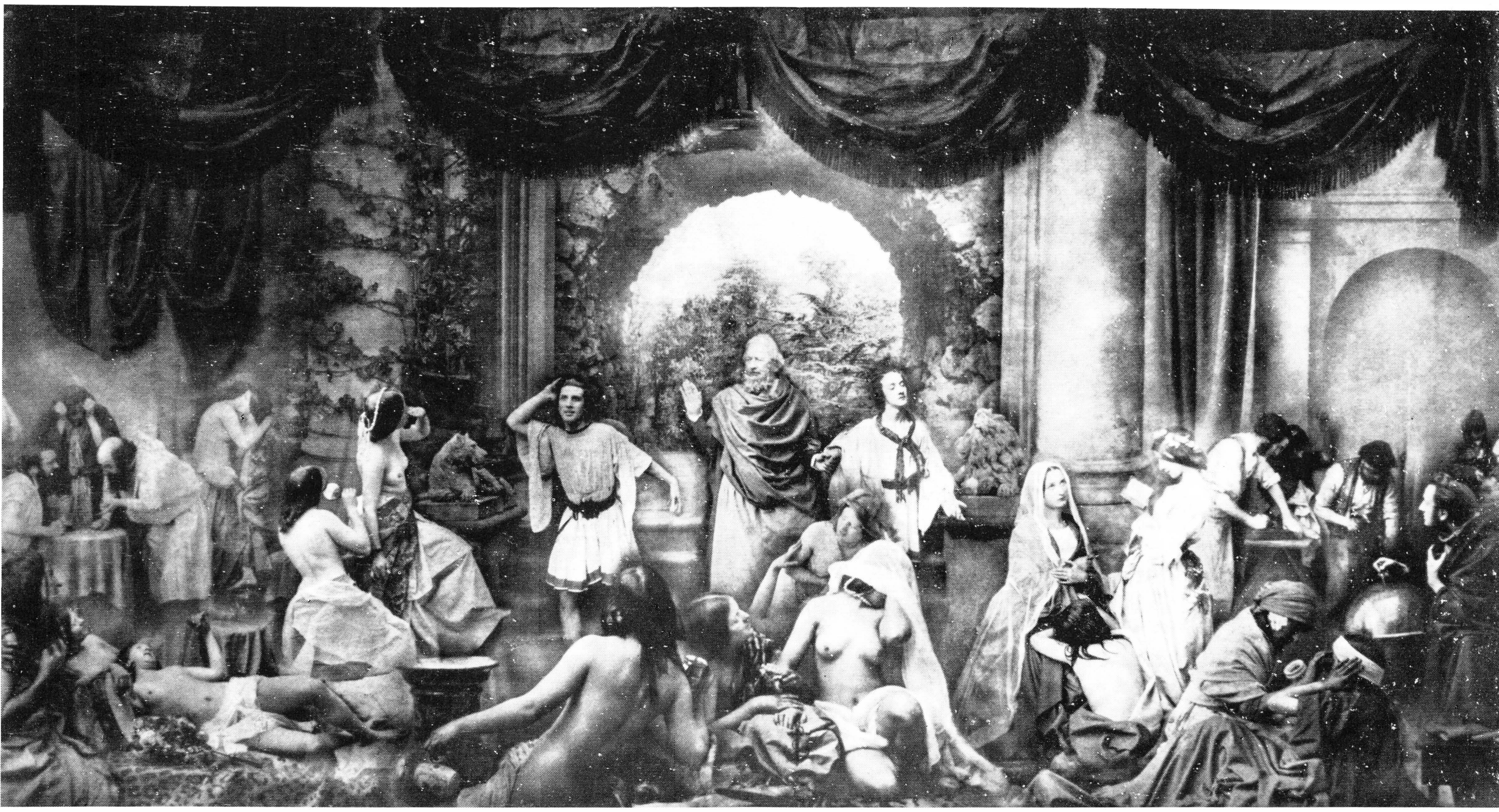
104 O. G. REJLANDER. 'The Two Ways of Life', 1857

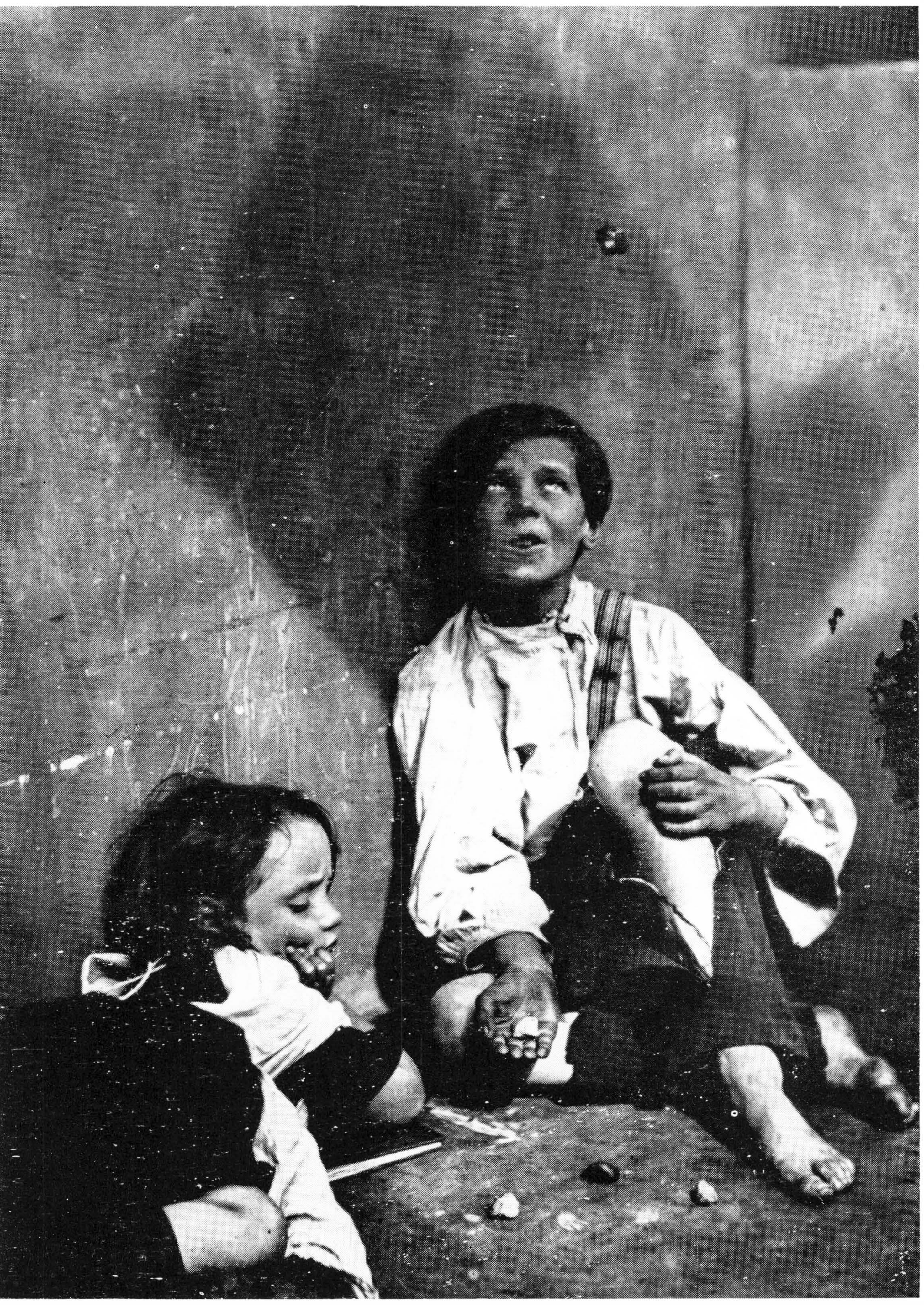
105 O. G. REJLANDER. Street urchins tossing chestnuts, *c.* 1857. The chestnut in the air was suspended by a fine thread

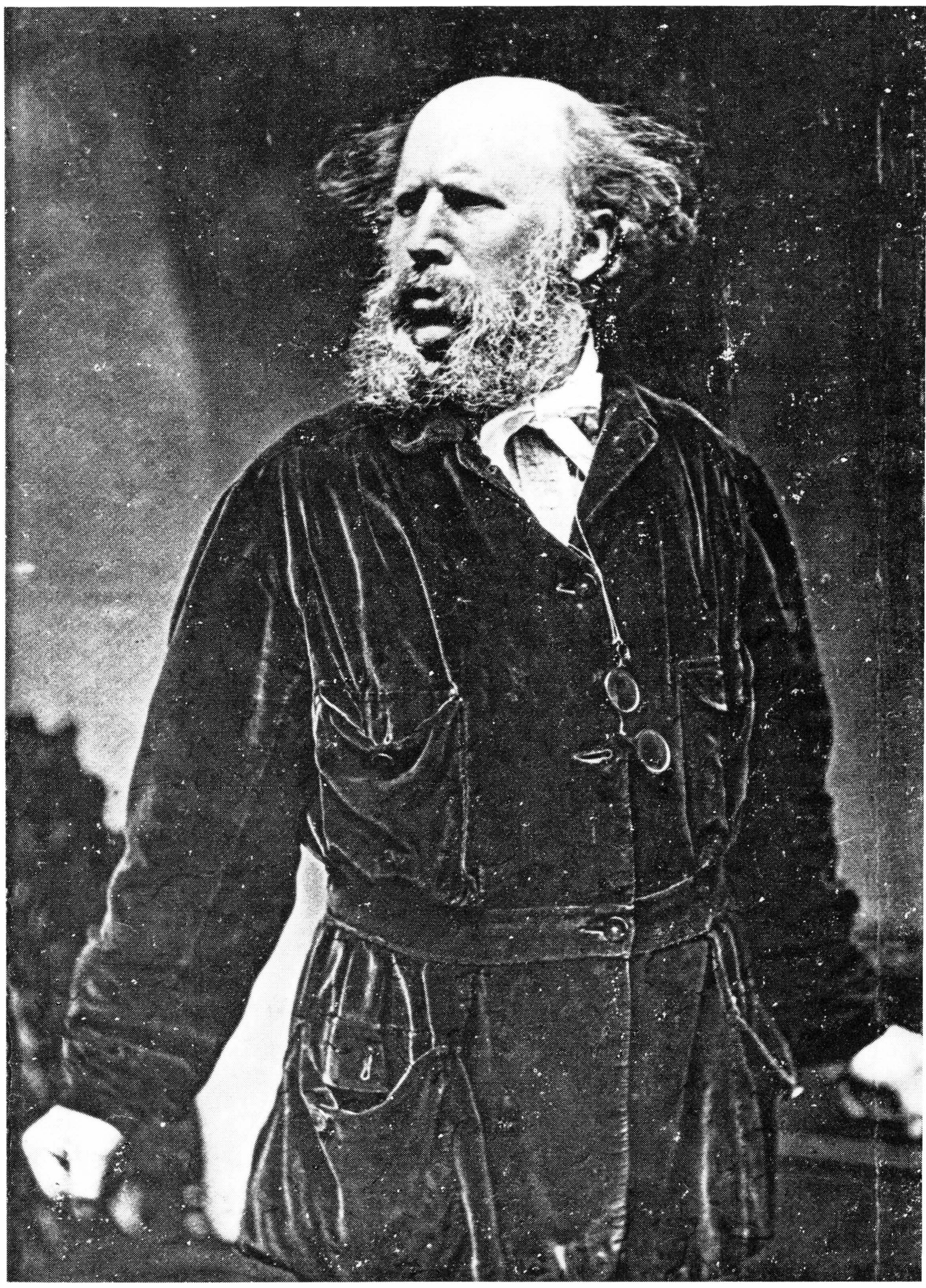
106 O. G. REJLANDER. Self-portrait from Darwin's *The Expression of the Emotions in Man and Animals.* Heliotype, 1872

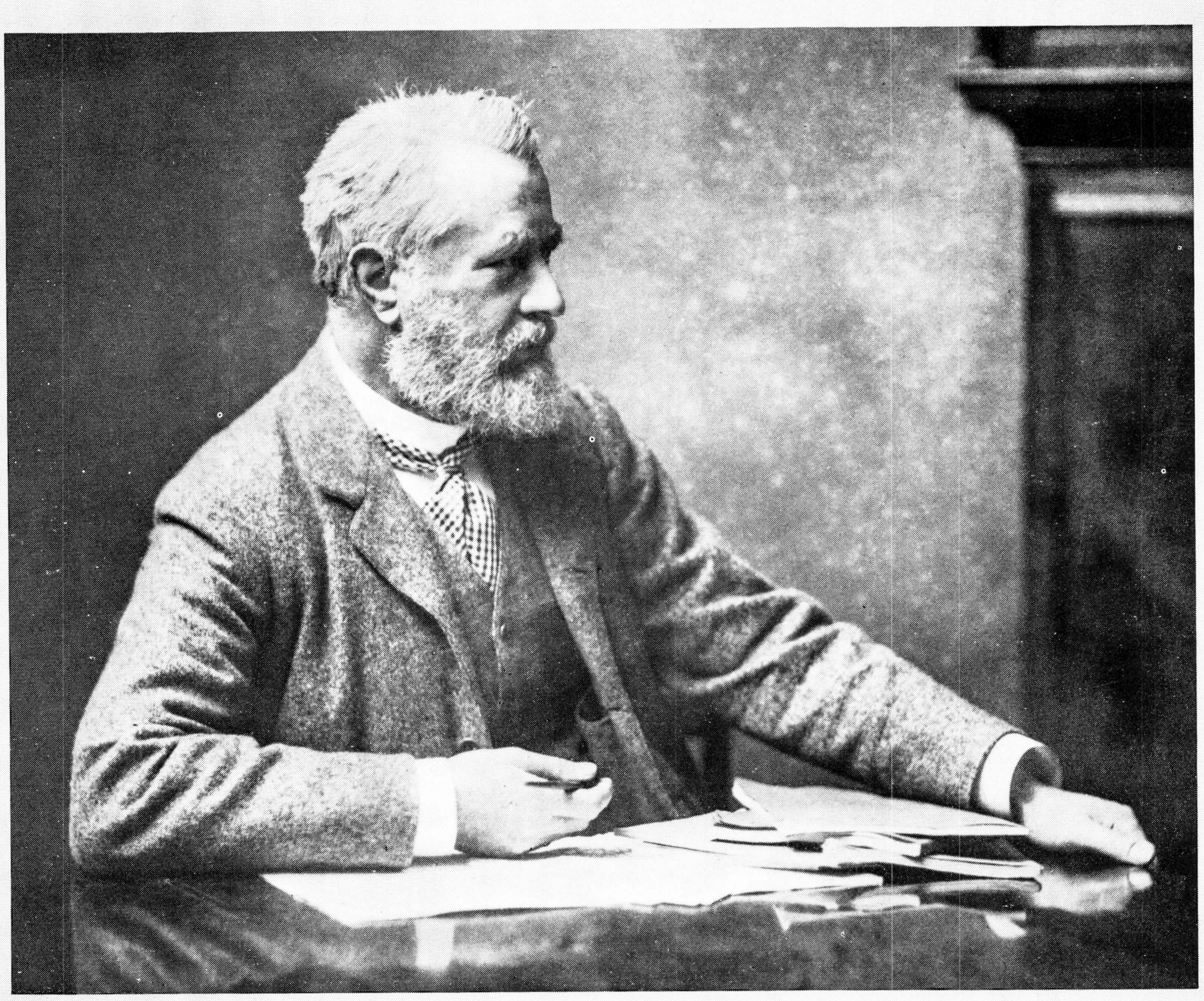










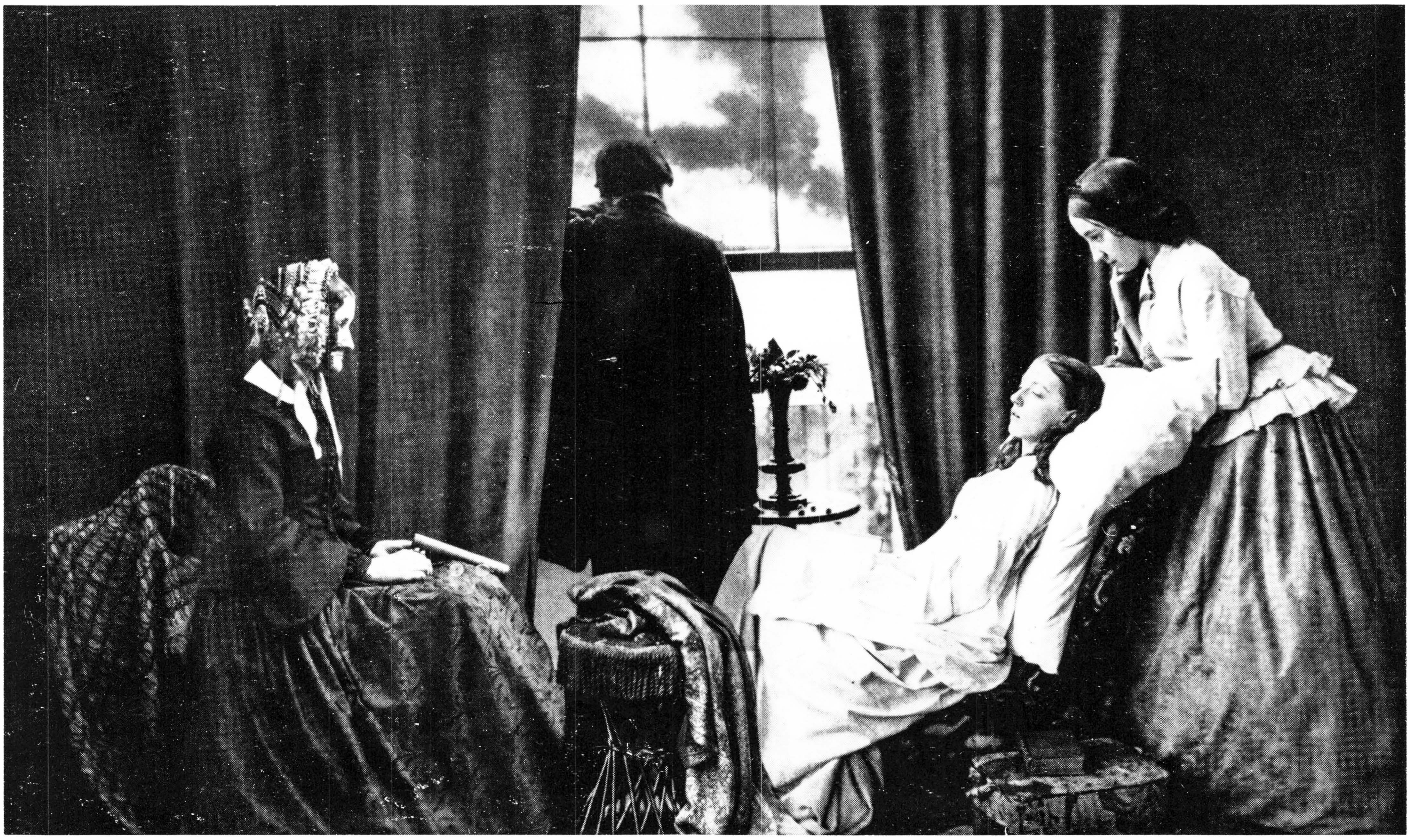


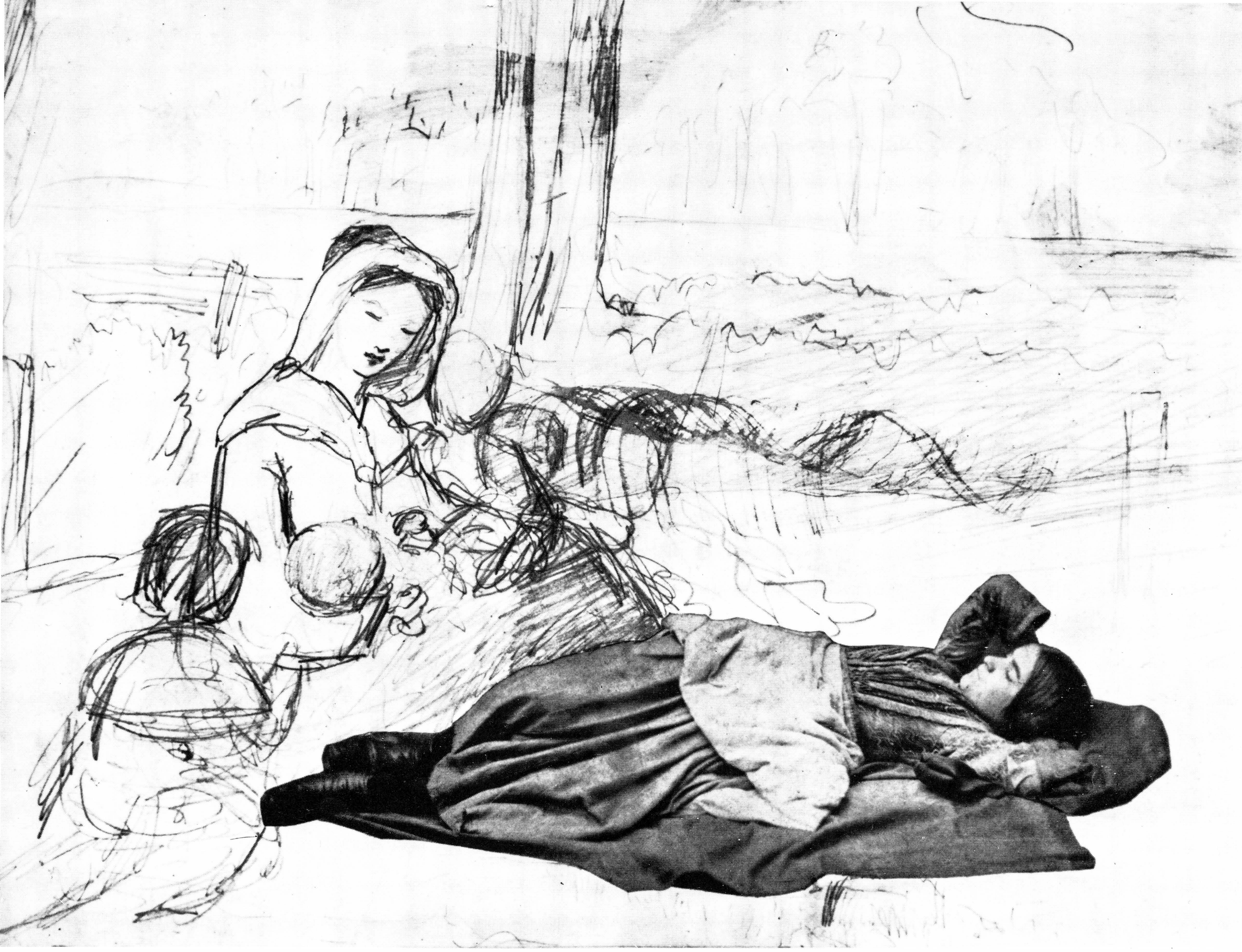
107 H. P. ROBINSON, photograph by his son, Ralph W. Robinson, 1897

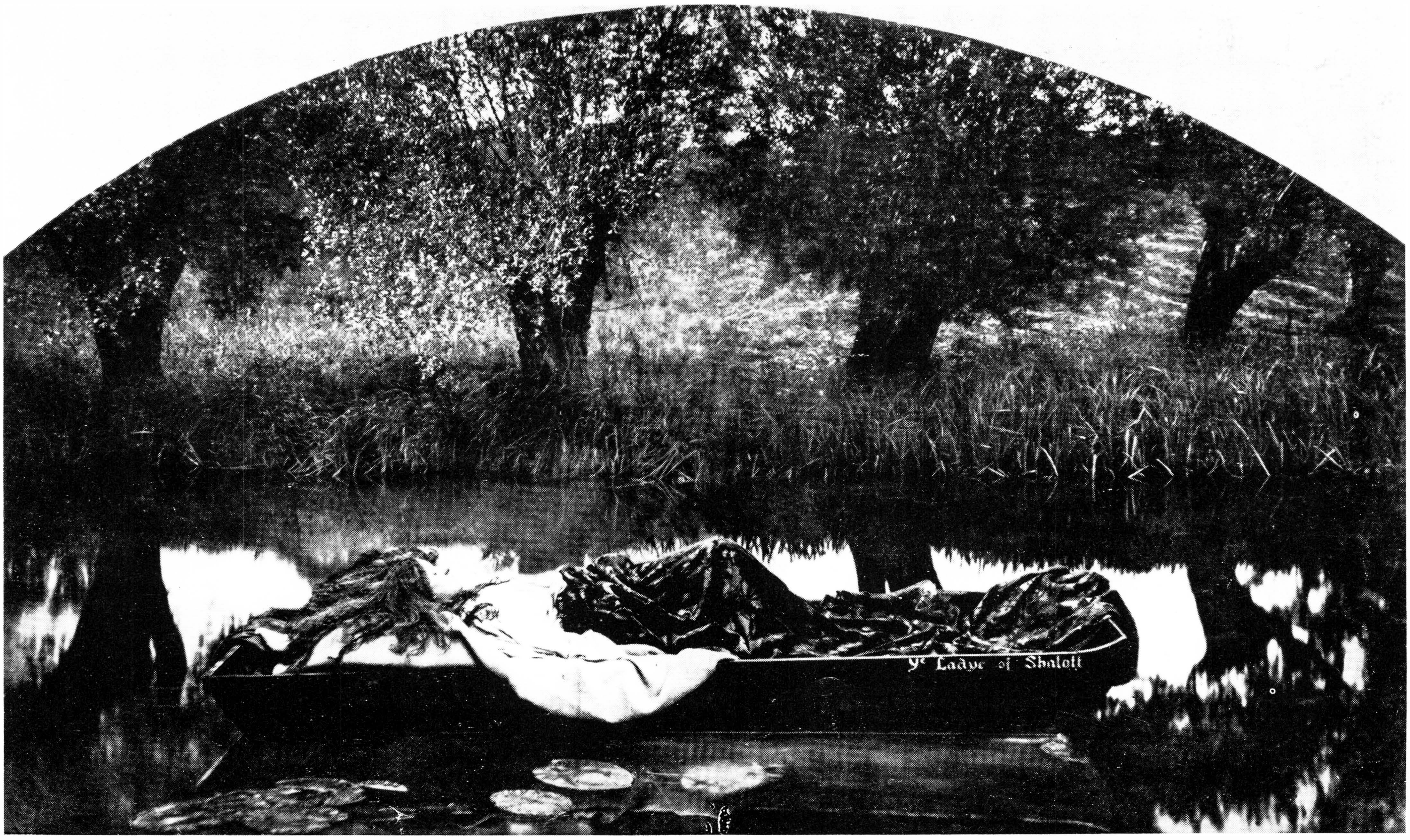
108 H. P. ROBINSON, 'Fading Away', 1858 (one of two versions)

109 H. P. ROBINSON. Pencil sketch with one photographic figure set in, *c.* 1860

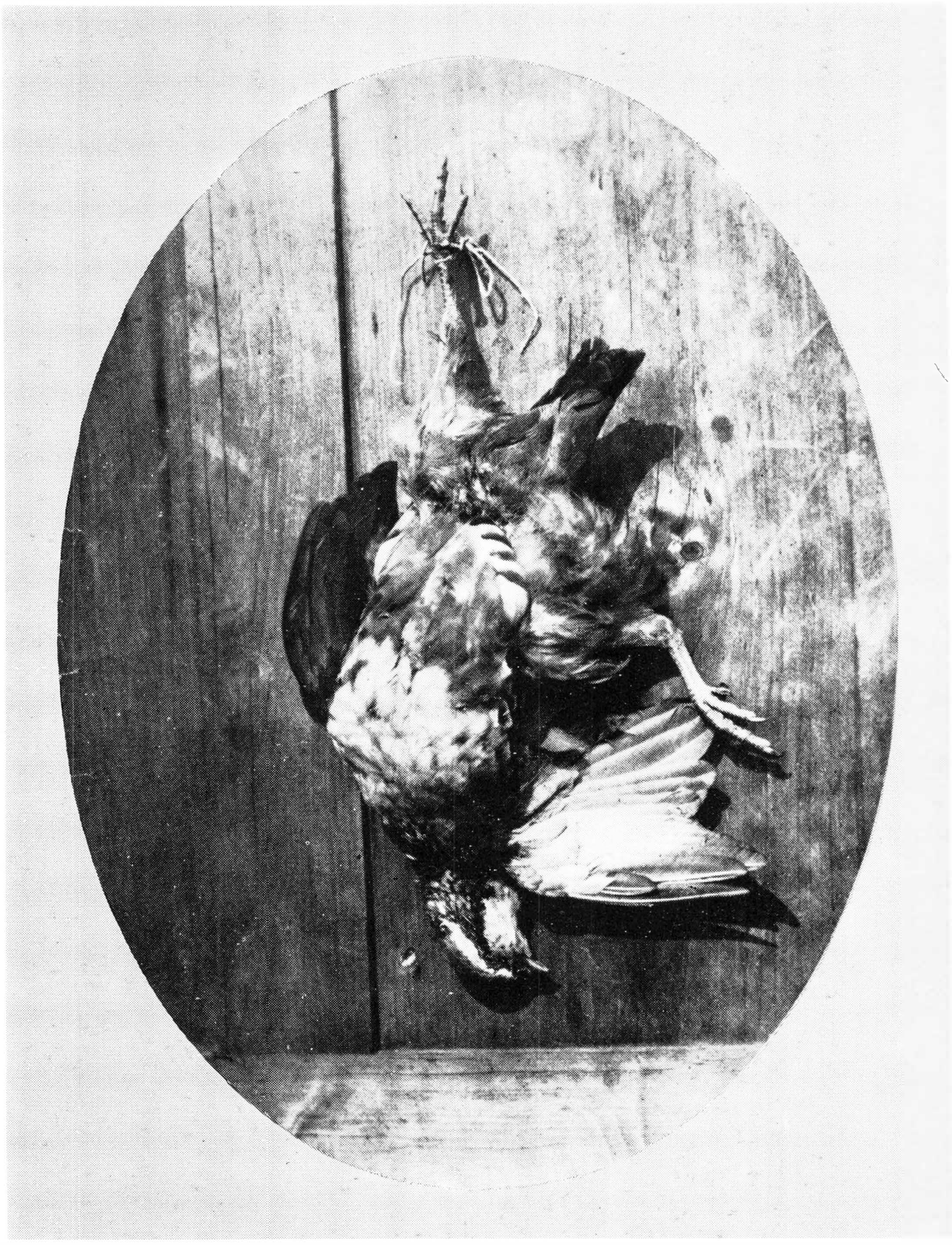
110 H. P. ROBINSON. 'The Lady of Shalott', 1861

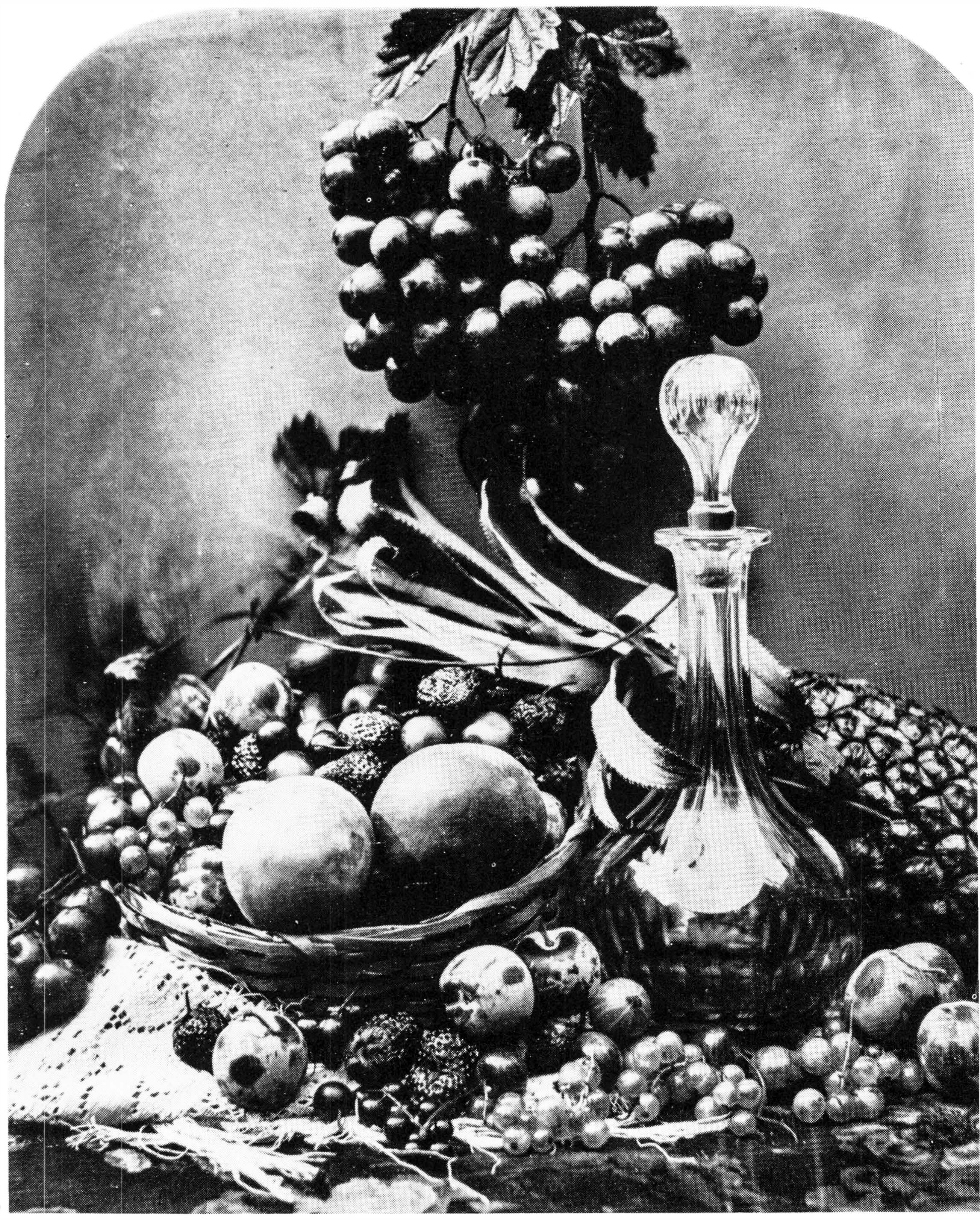


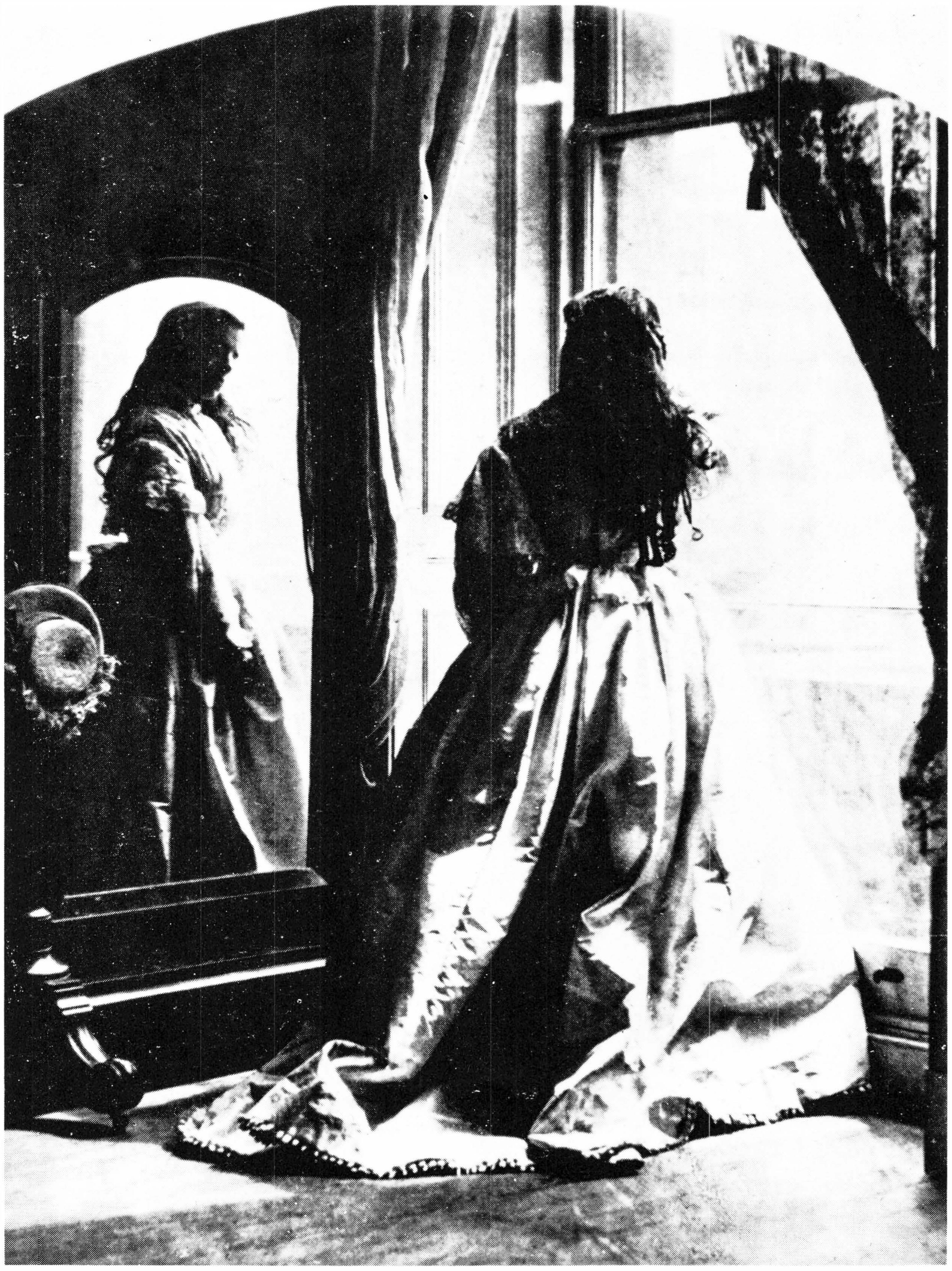




Ye Ladye of Shalott







111 WILLIAM LAKE PRICE. Dead game, *c.* 1855

112 ROGER FENTON. Still-life, *c.* 1858

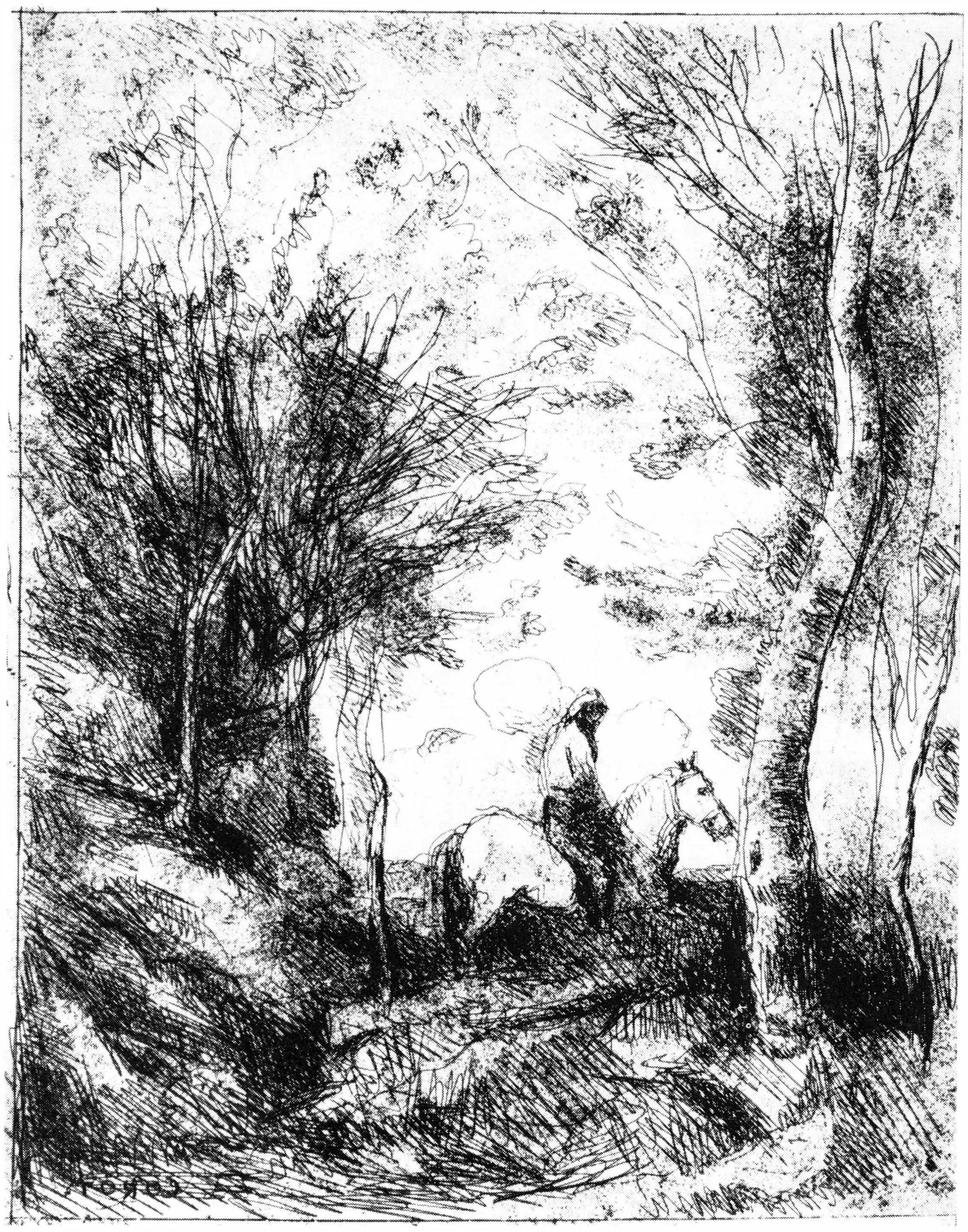
113 LADY HAWARDEN. 'The Toilet', *c.* 1864

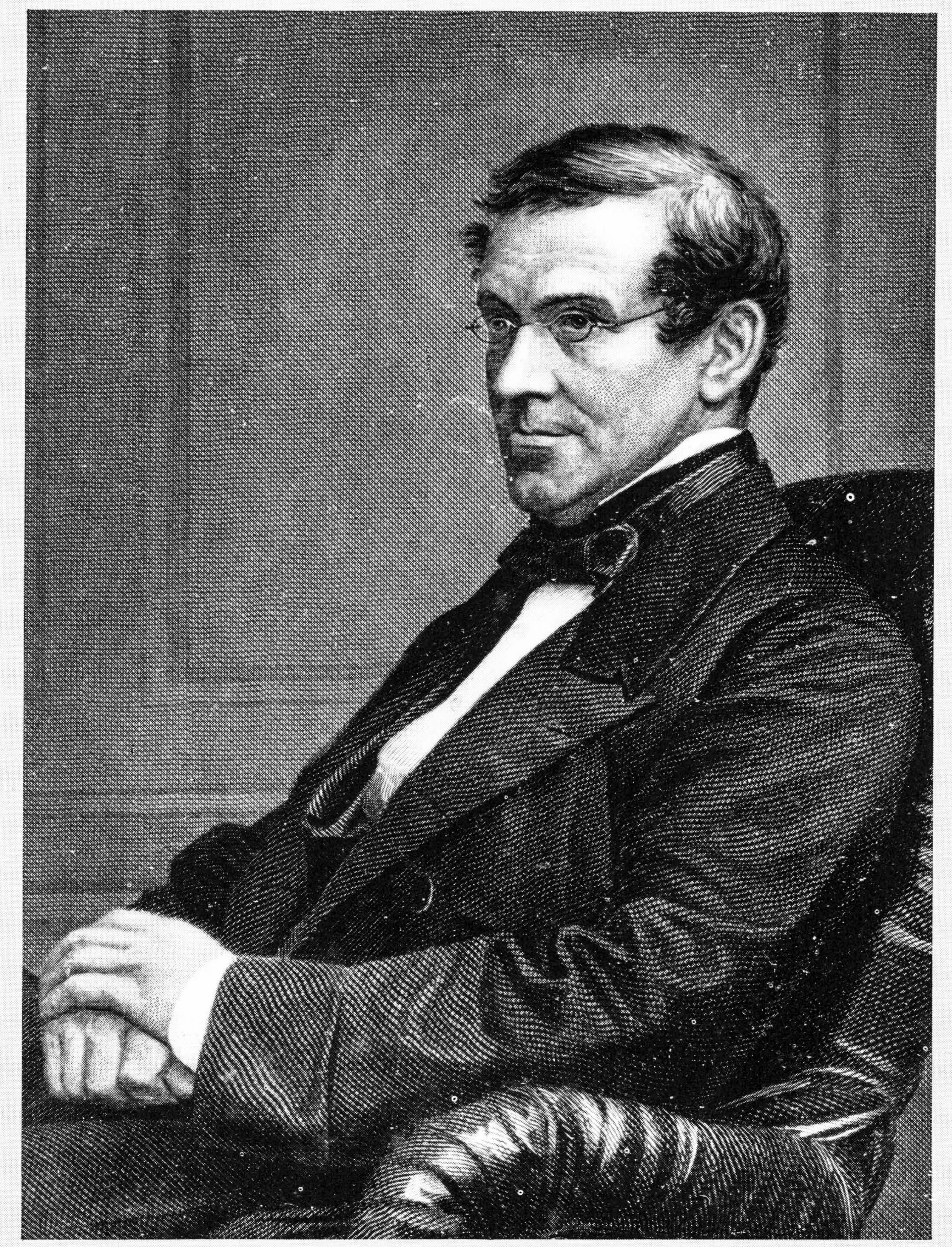
114 CAMILLE COROT. 'Le Grand Cavalier sous Bois'. Cliché-verre, 11¾ in. × 9½ in., *c.* 1856

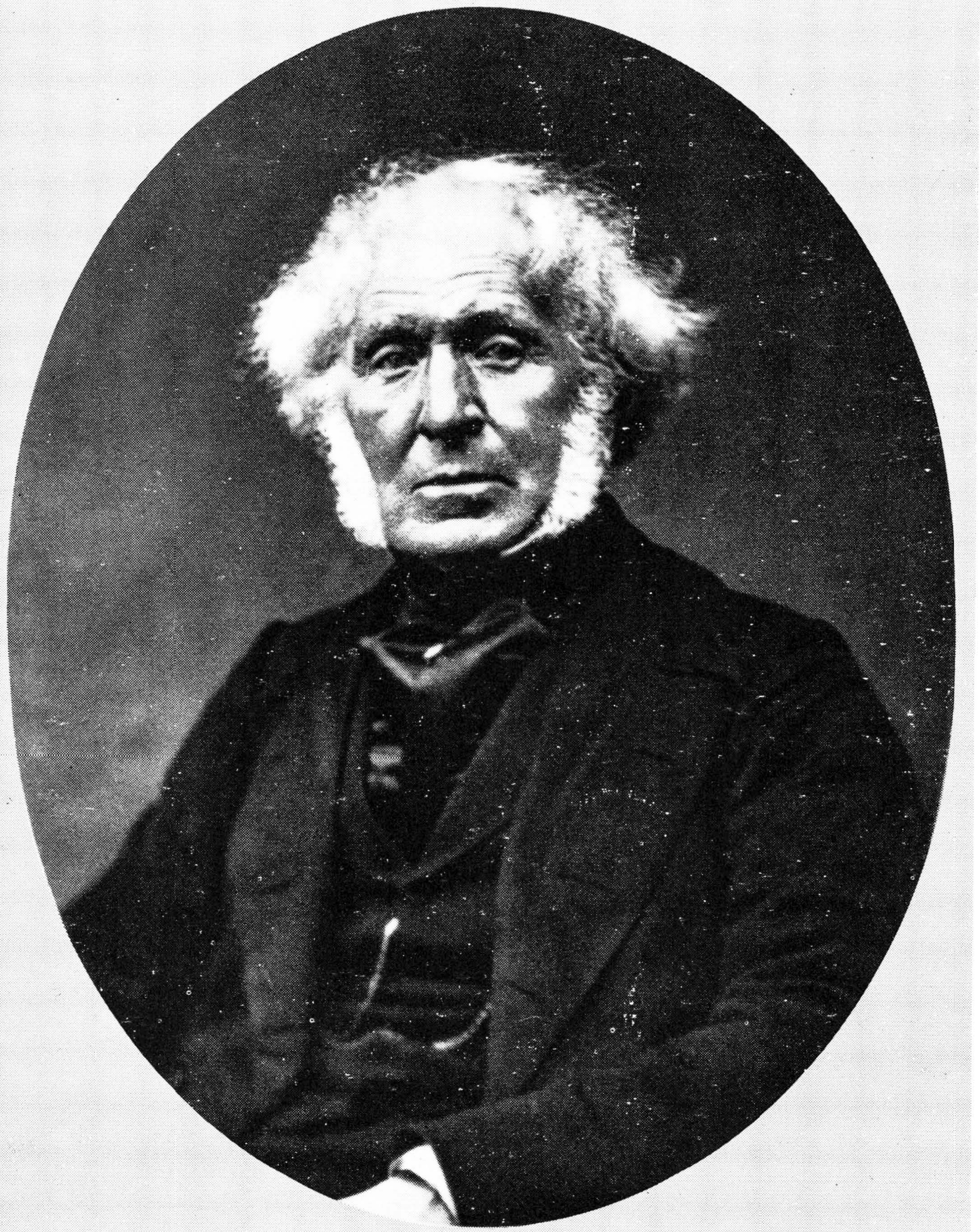
115 SIR CHARLES WHEATSTONE, F.R.S., engraving from a photograph by W. E. KILBURN, *c.* 1855

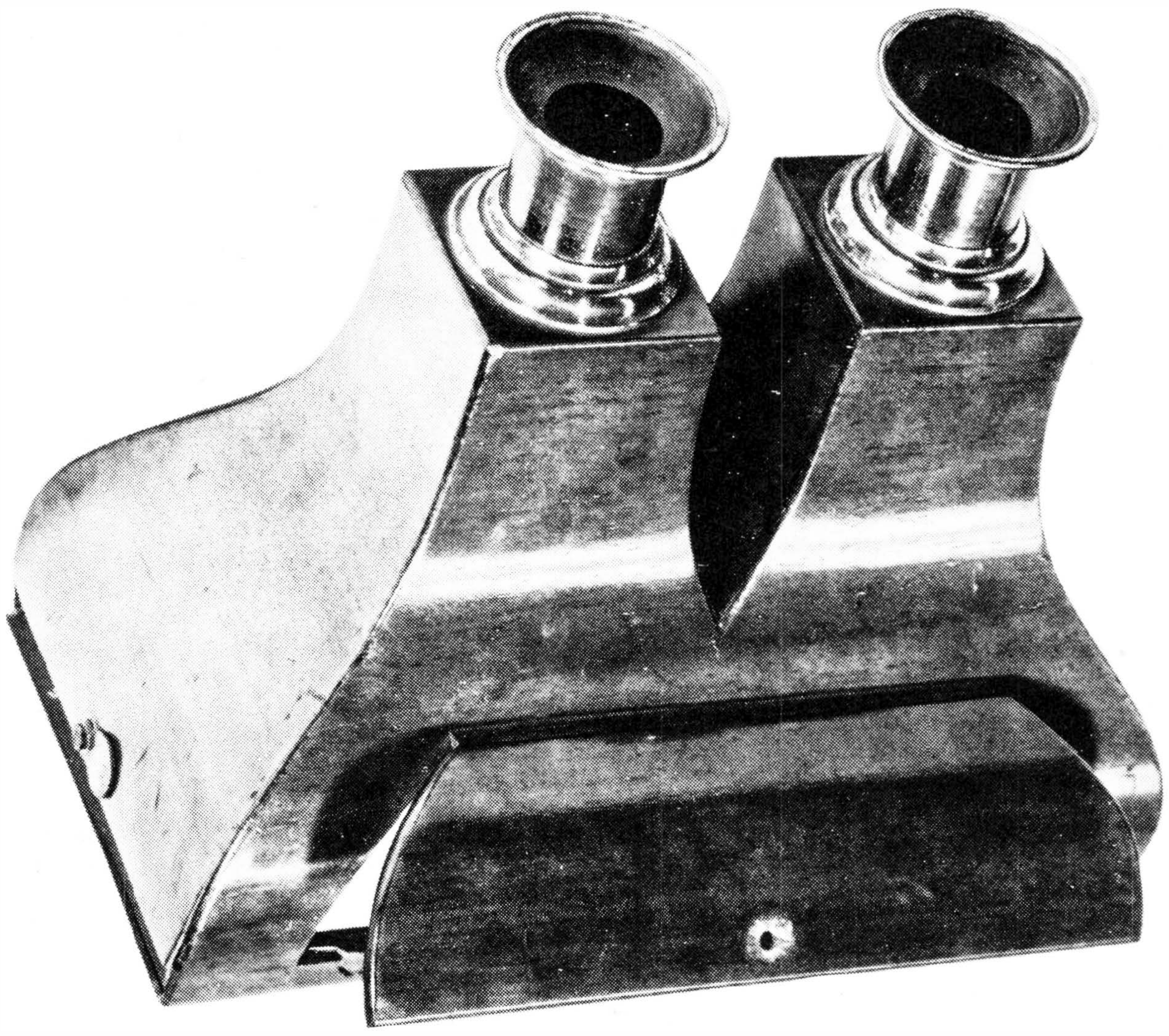
116 ANTOINE CLAUDET. 'The Geography Lesson'. Stereoscopic daguerreotype, 1851

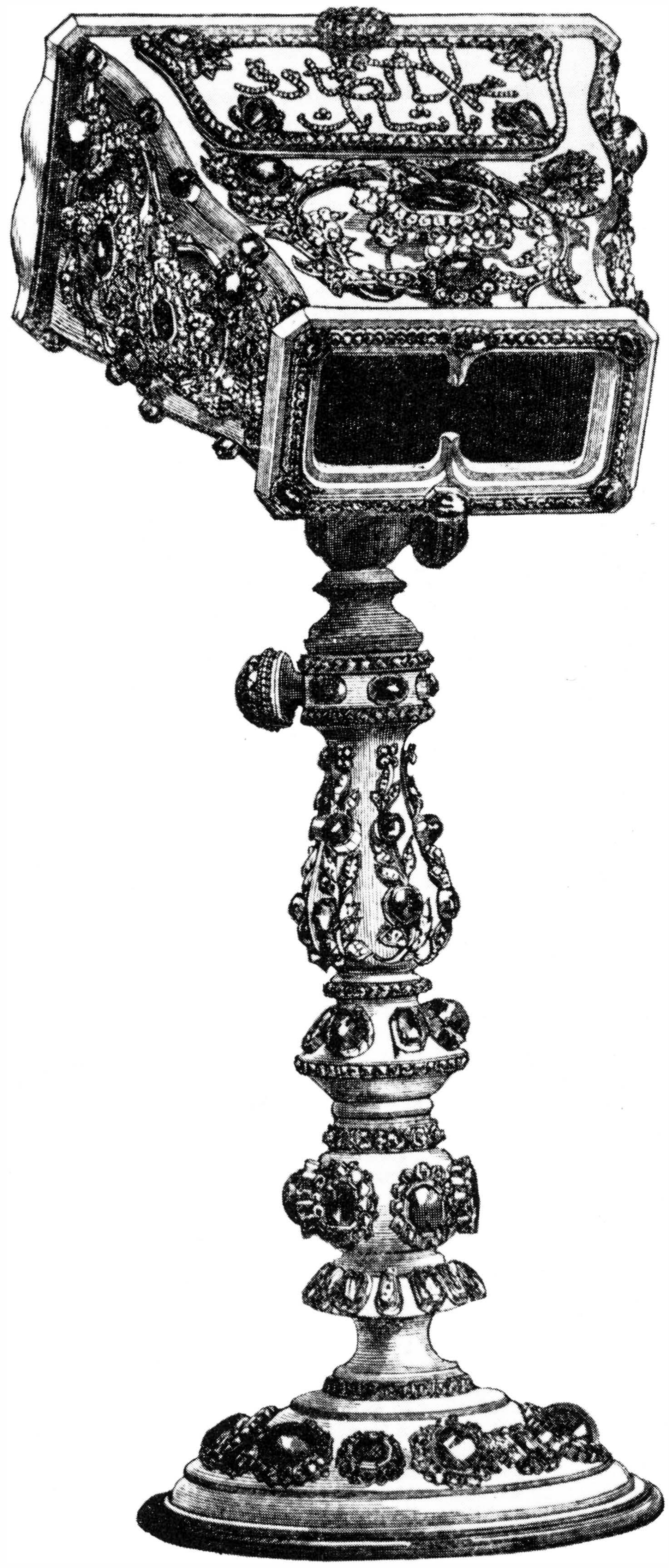
117 SIR DAVID BREWSTER, F.R.S., photograph by EDWIN MUSGRAVE, *c.* 1865

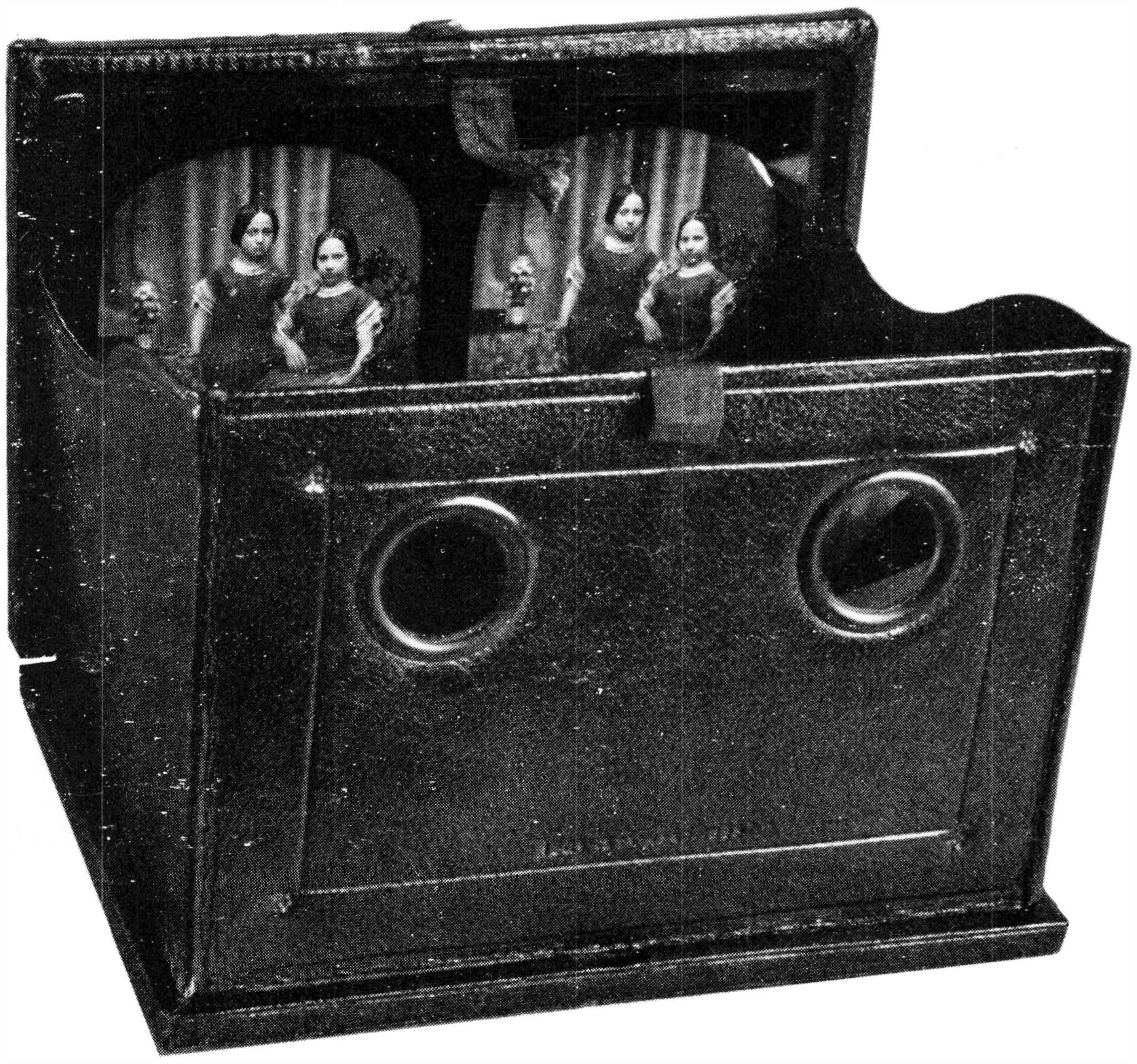












118 CLAUDET's lenticular stereoscope, with adjustable eye tubes, 1855; this was an improvement on Brewster's design

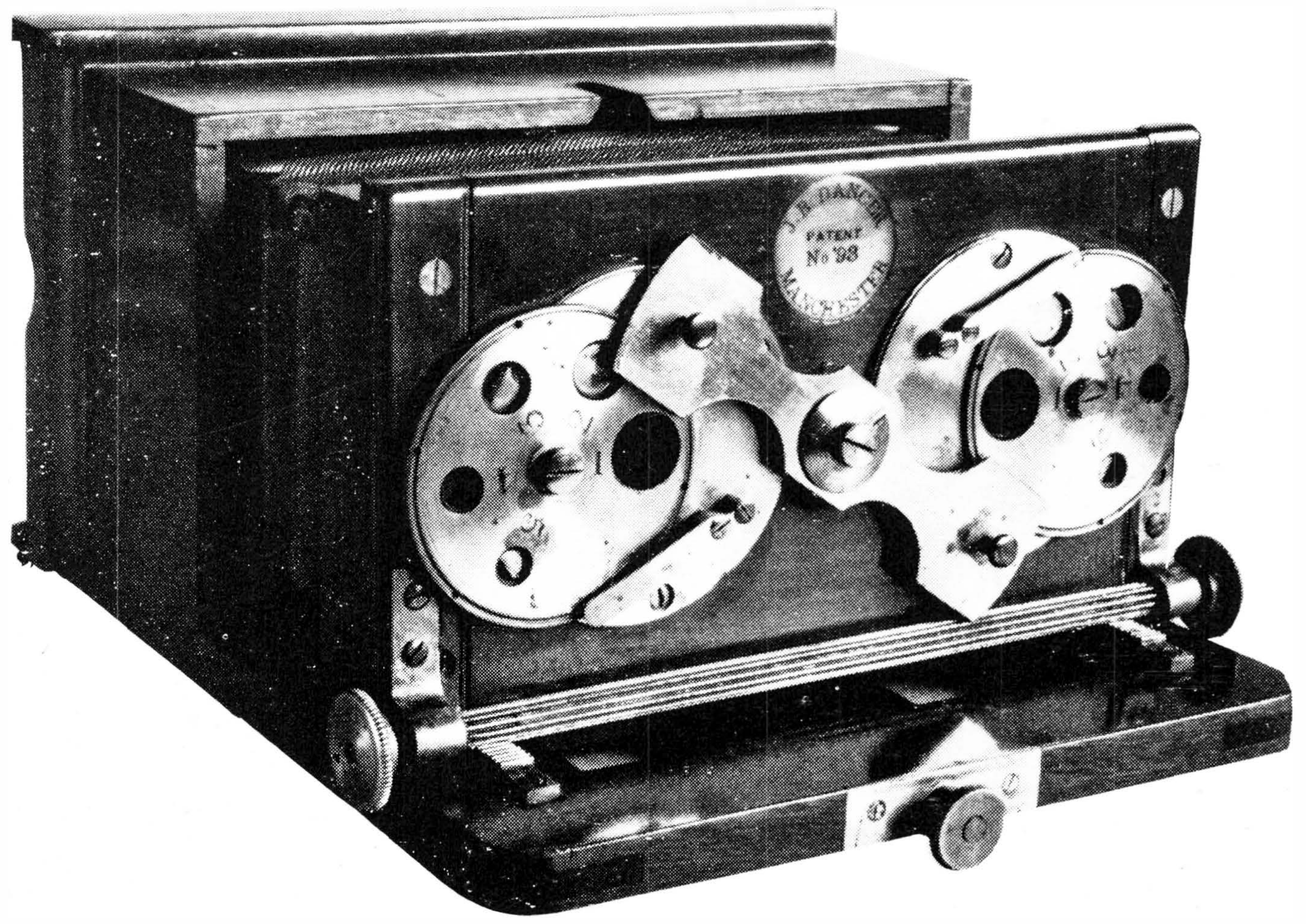
119 W. E. KILBURN's folding pocket stereoscope, similar to CLAUDET's instrument, January 1853

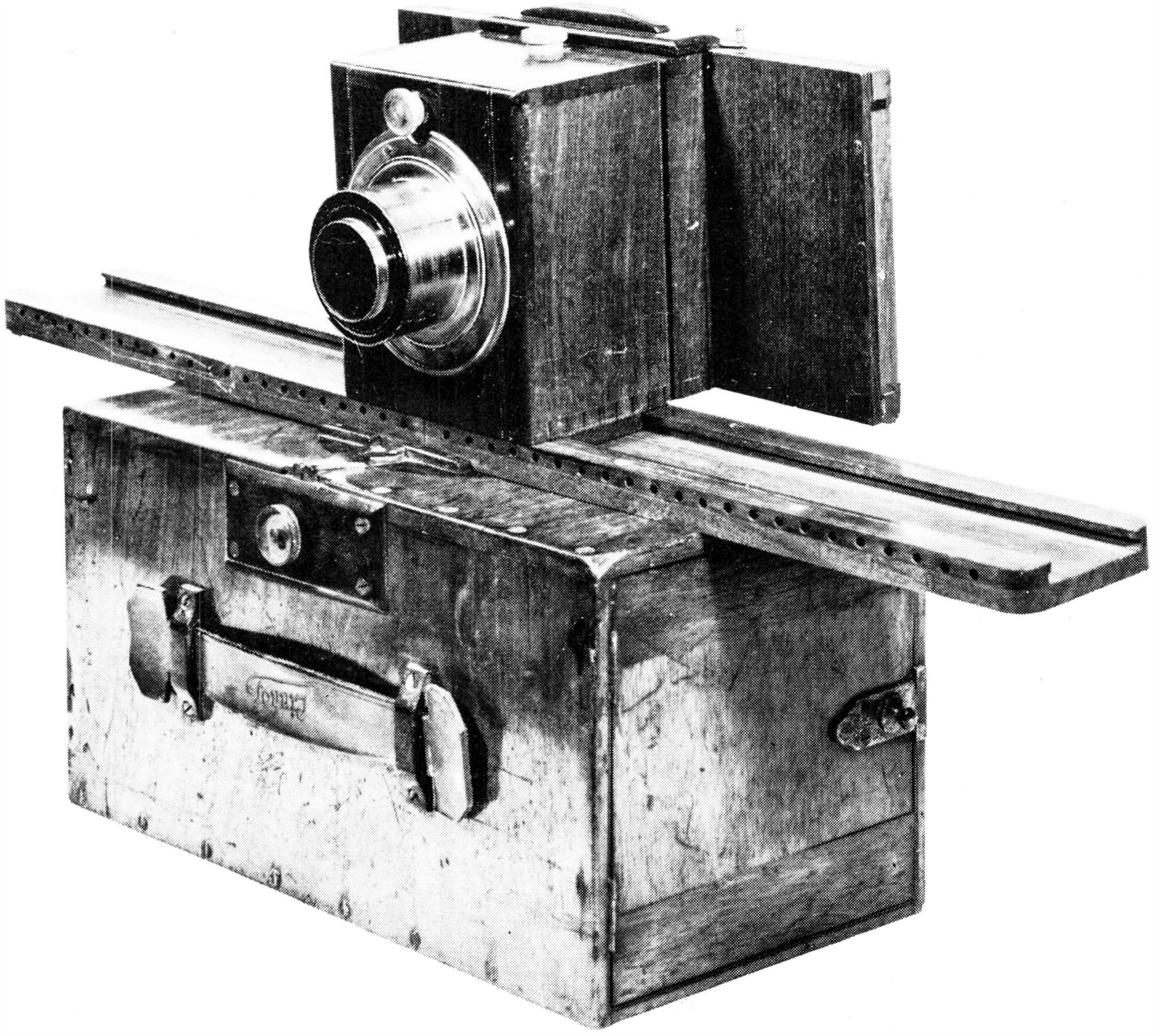
120 Stereoscope by EMANUEL for an oriental potentate, London, 1862

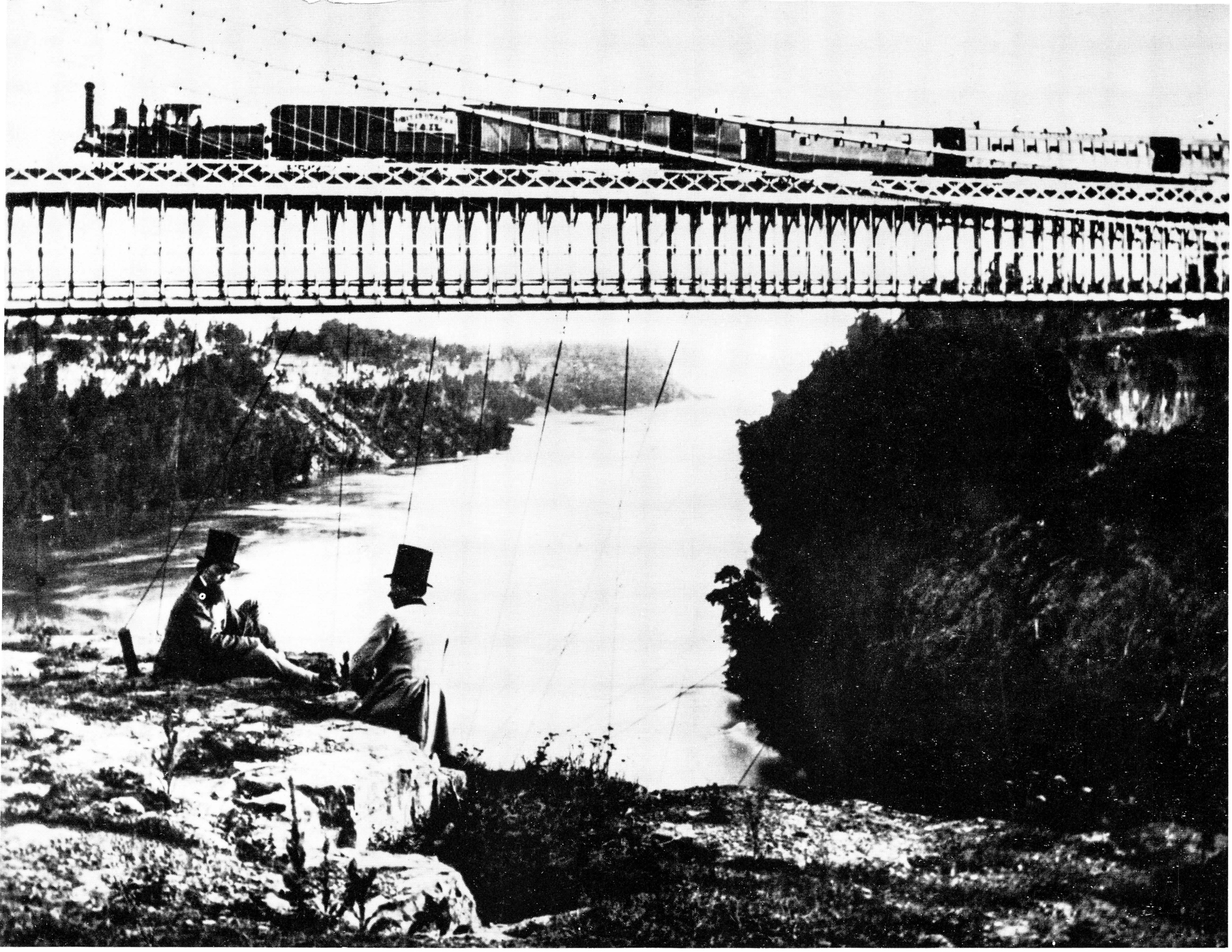
121 J. B. DANCER's binocular stereoscopic camera, 1856

122 F. H. POWELL's single-lens stereoscopic camera, 1858

123 WILLIAM ENGLAND. Train crossing the Niagara River. Stereoscopic photograph, 1859

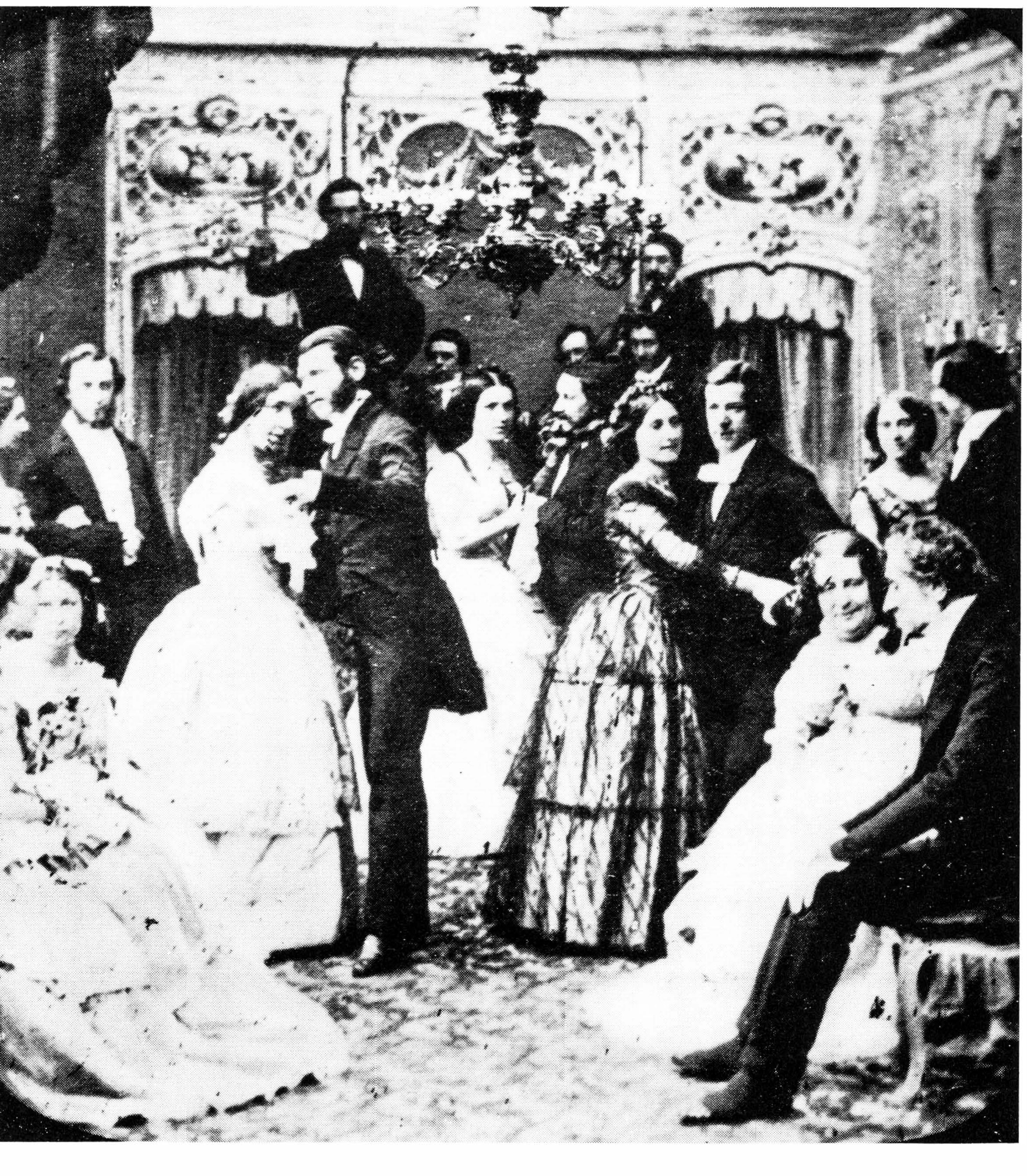


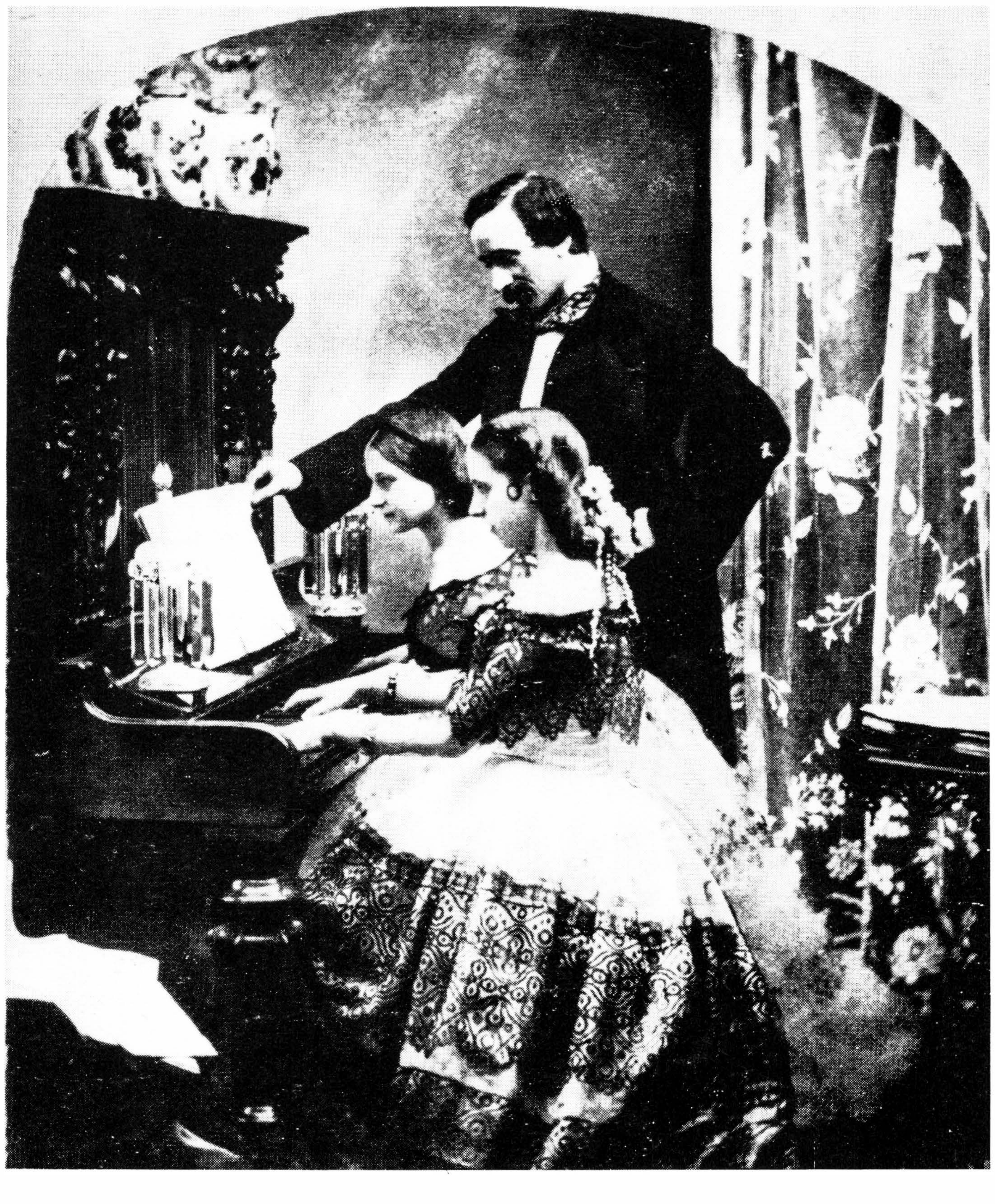


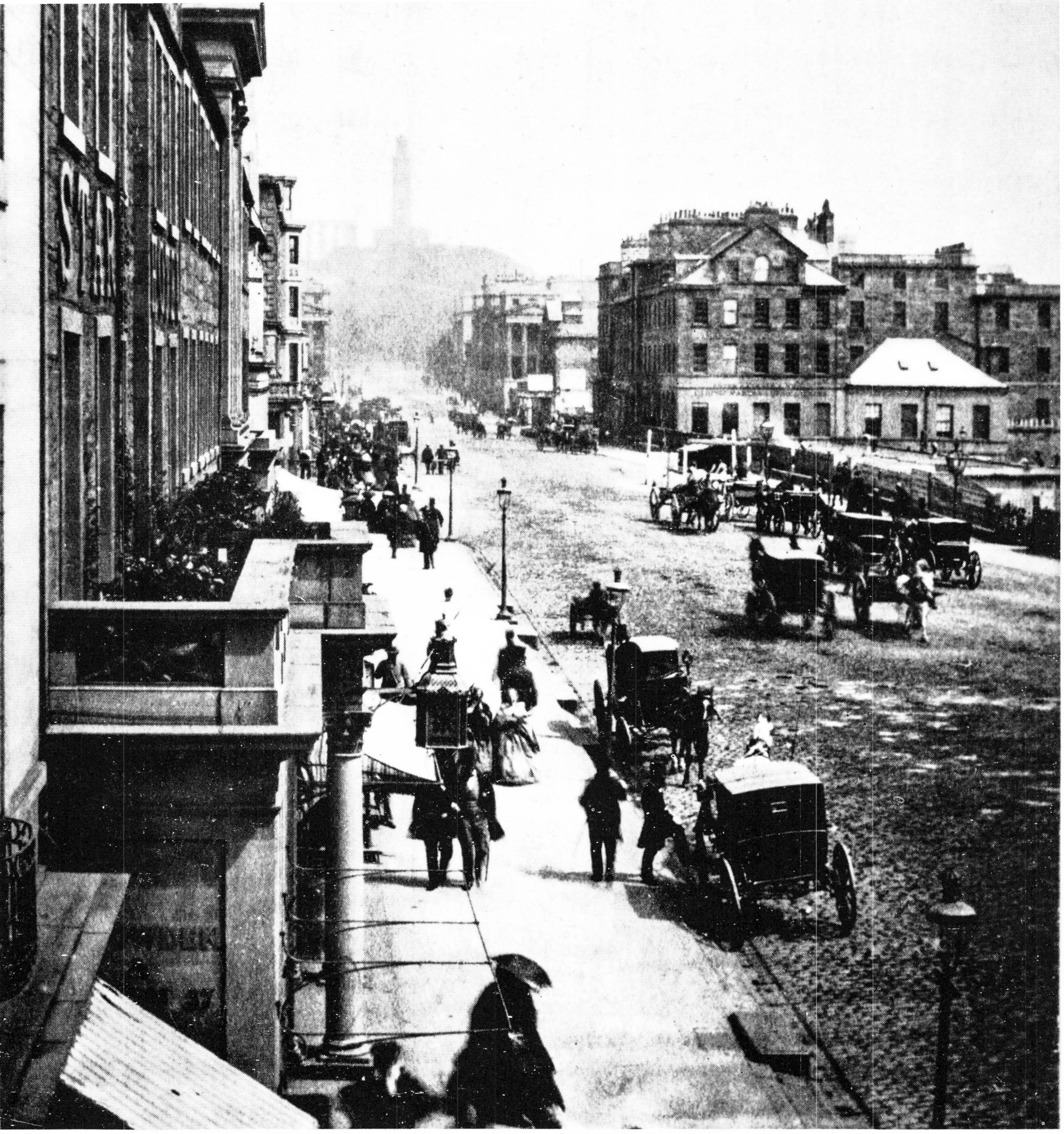


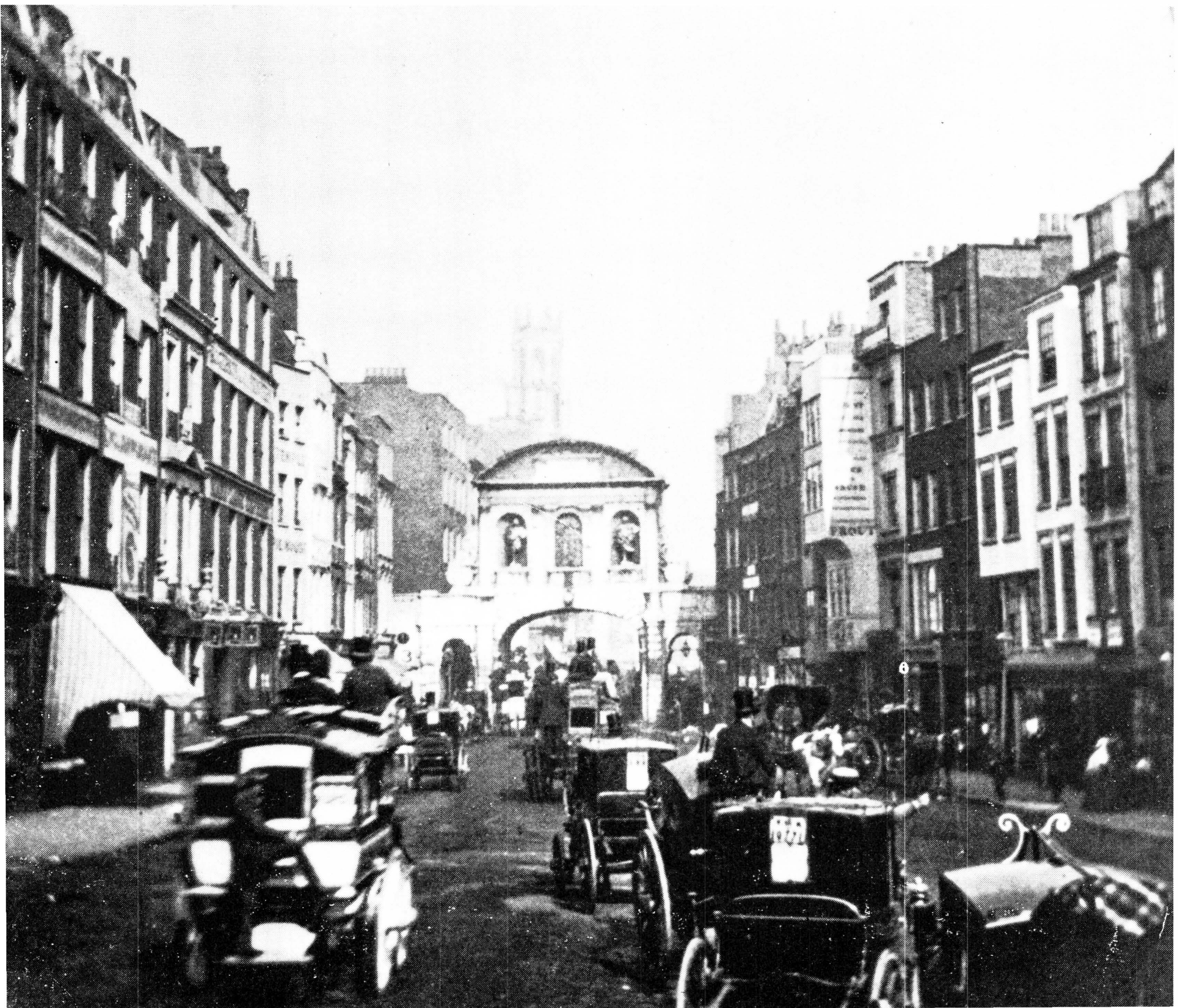
124 Unknown photographer. Ballroom scene. Stereoscopic photograph, *c.* 1855

125 Unknown photographer. 'The Music Lesson'. Stereoscopic photograph, *c.* 1857









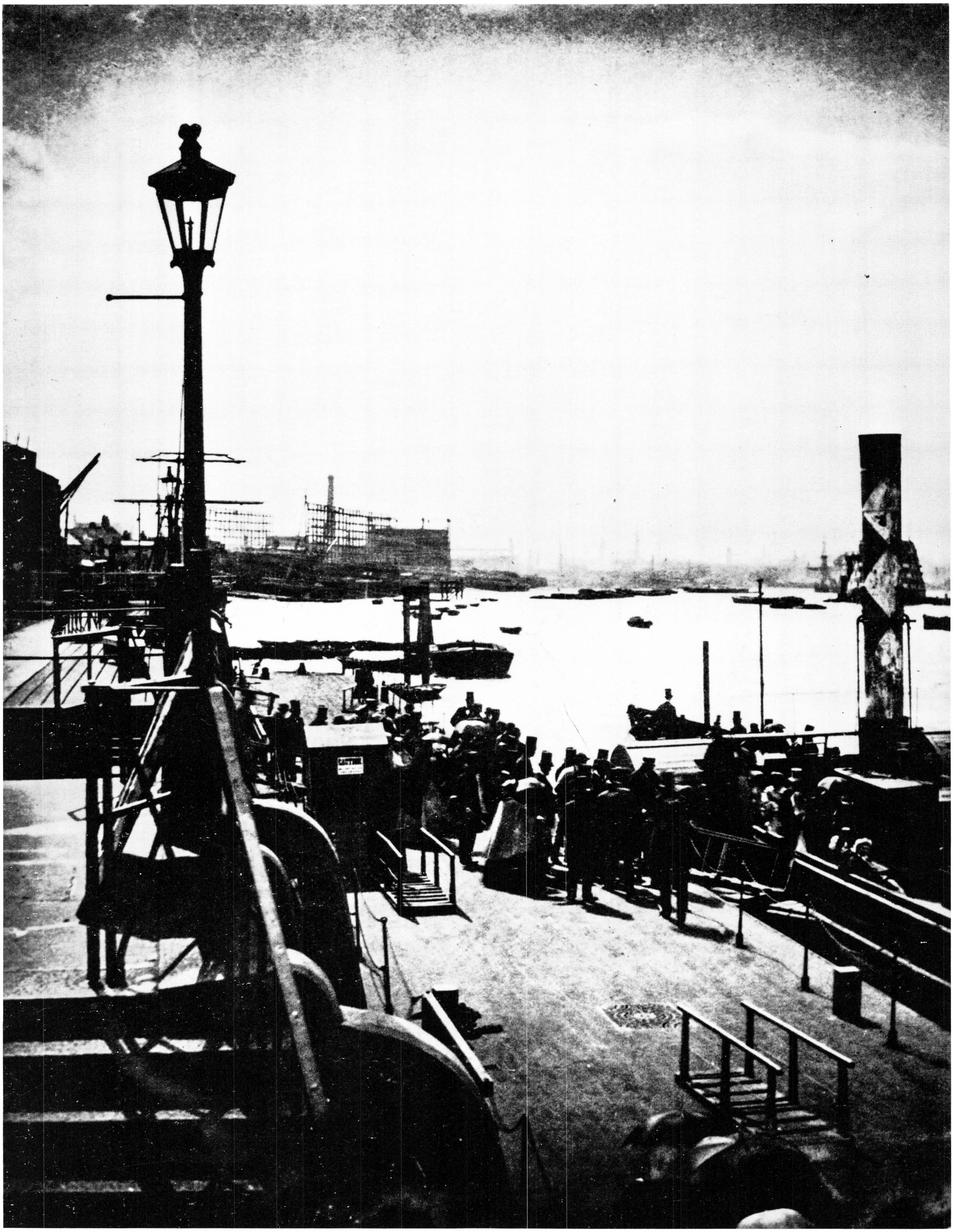
126 G. W. WILSON. Princes Street, Edinburgh. Stereoscopic photograph, 1857

127 VALENTINE BLANCHARD. Temple Bar, London. Stereoscopic photograph, 1862

128 E. ANTHONY. Broadway, New York, on a rainy day. Stereoscopic photograph, August 1859

129 Unknown photographer. Election meeting at Dover, 1865

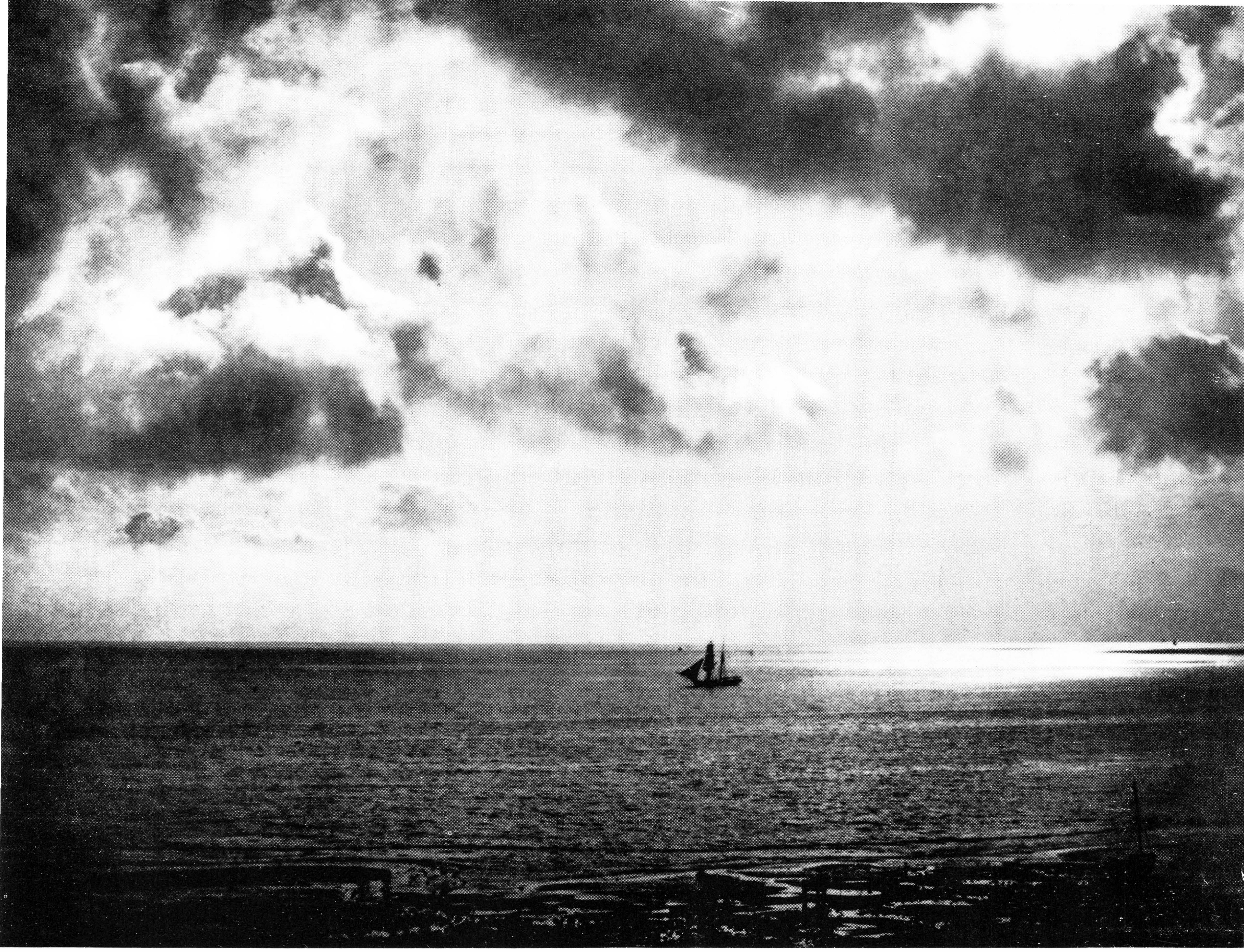
HATTER

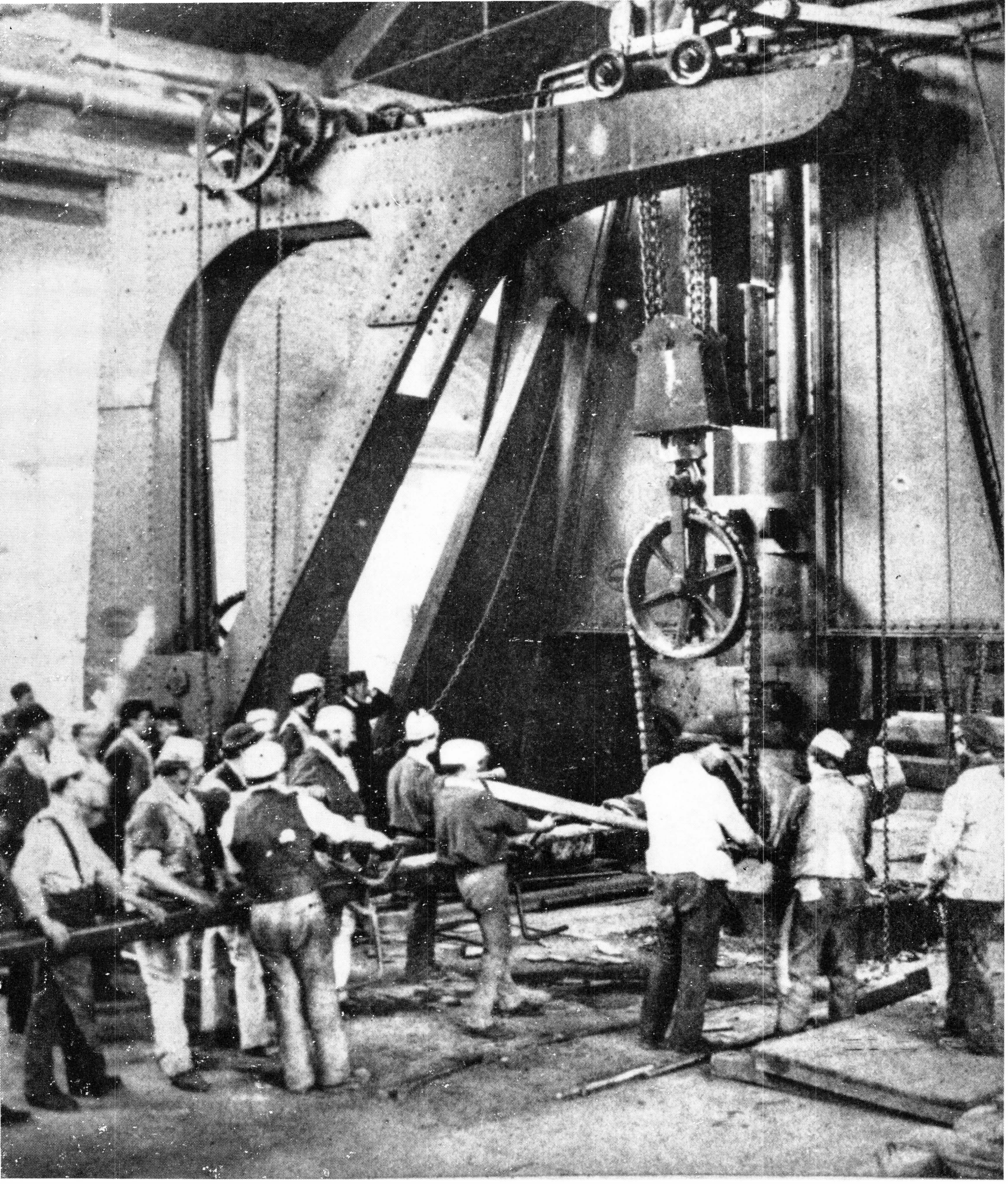


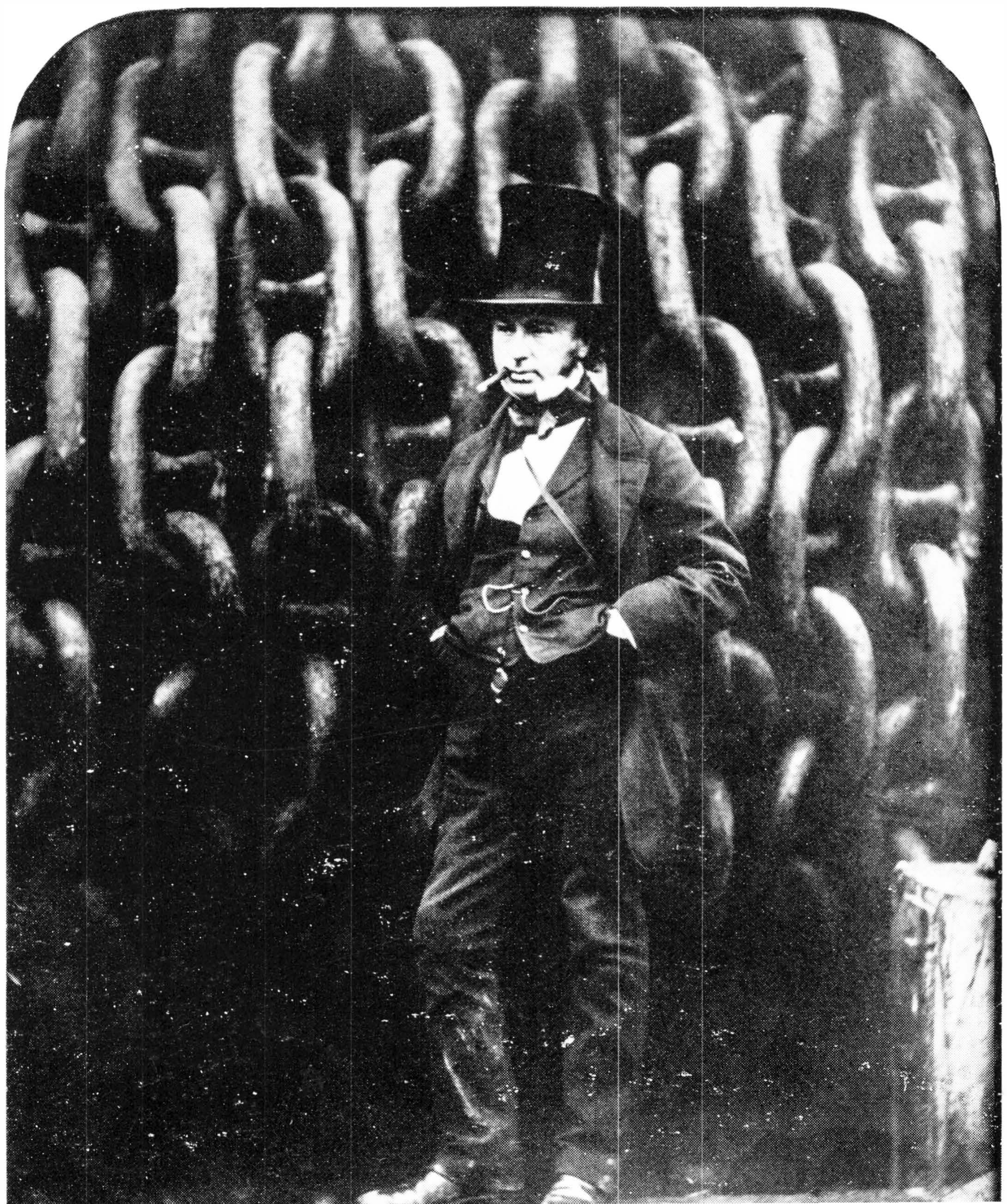
130 G. W. WILSON. Waiting for the boat, Greenwich. Stereoscopic photograph, 1857

131 GUSTAVE LE GRAY. 'Brig upon the water', 1856

132 G. W. WILSON. The Loch of Park. Stereoscopic photograph, July 1856





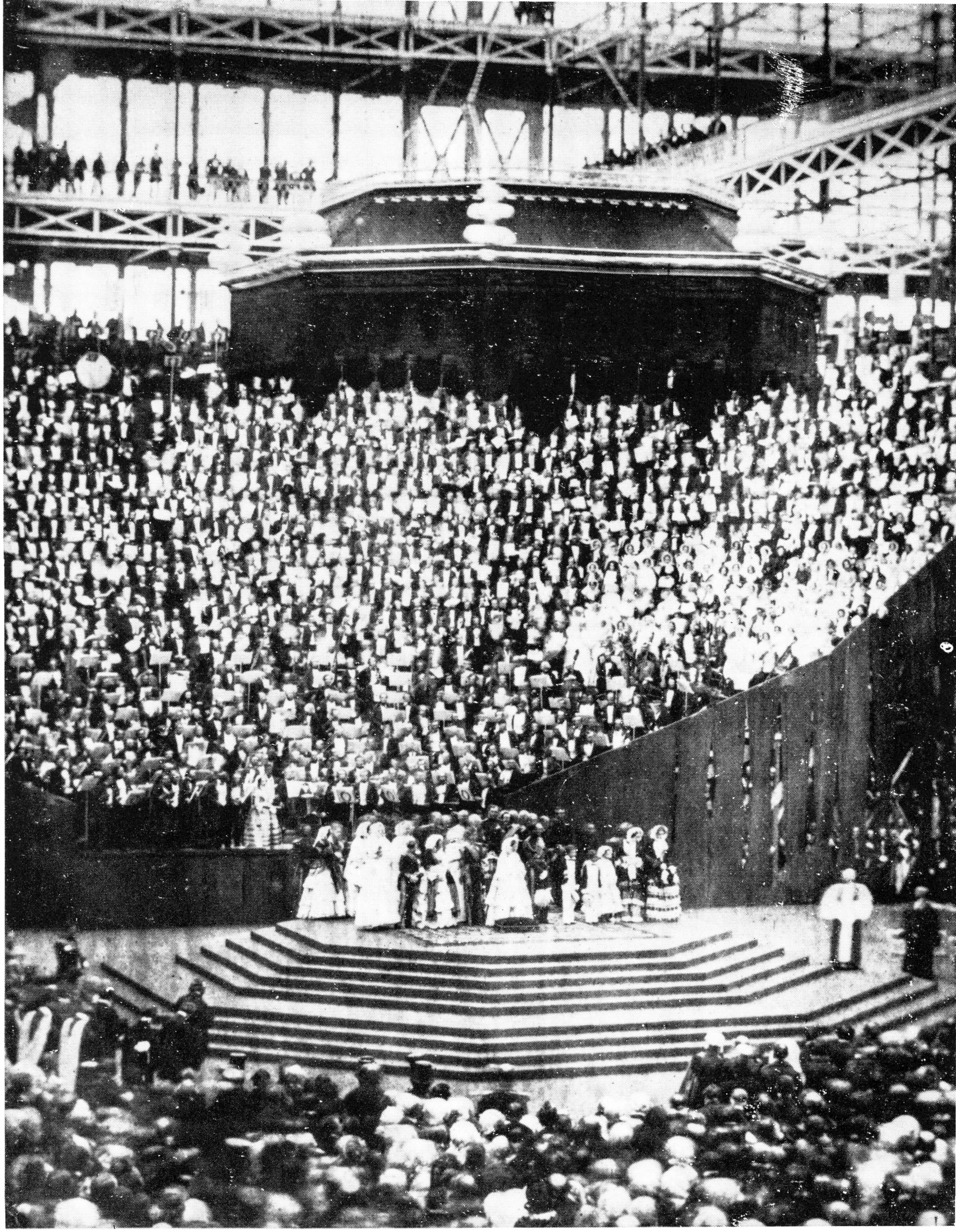


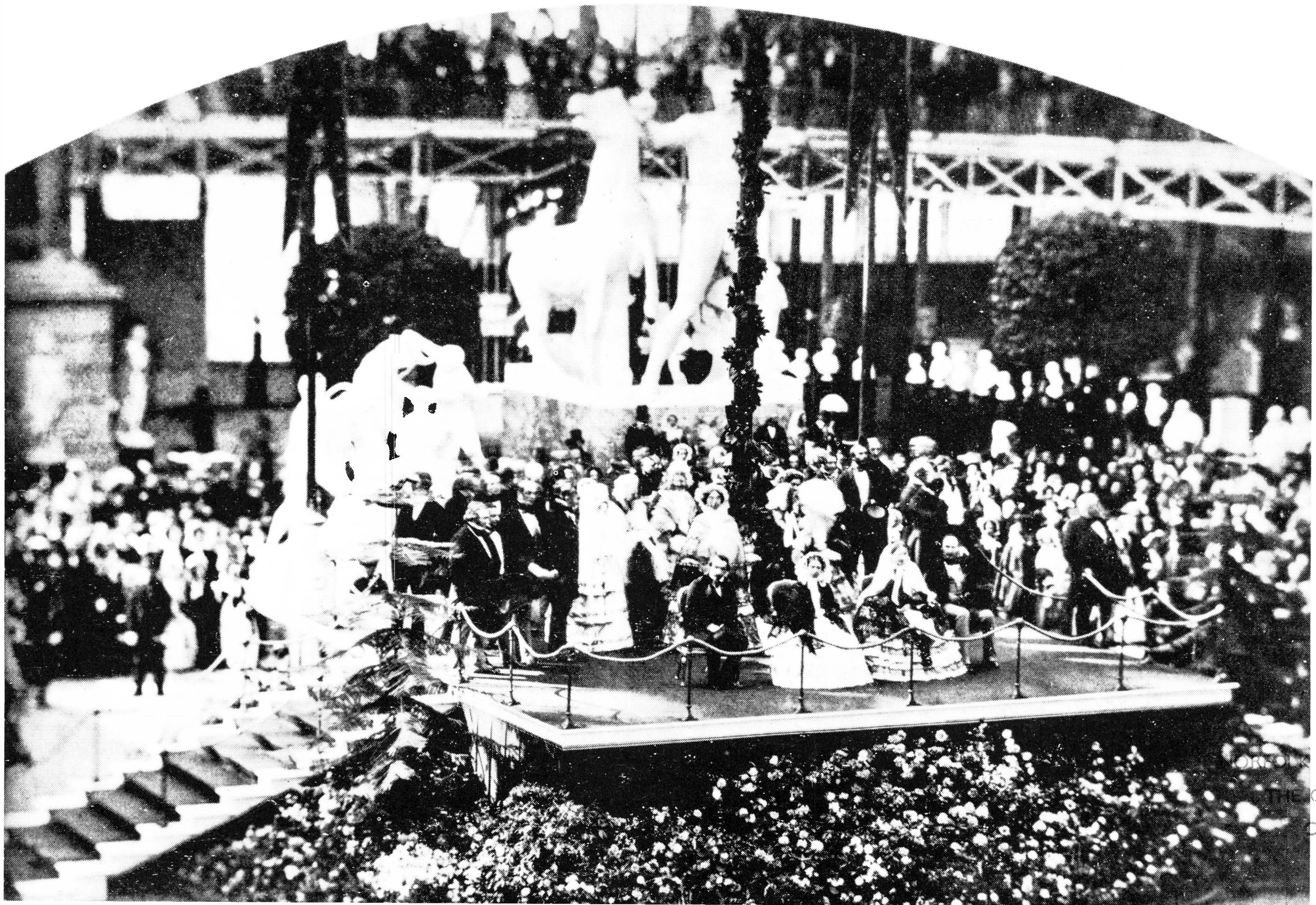
133 REV. THEOPHILUS SMITH. The great steam-hammer, Atlas Works, Sheffield. Stereoscopic photograph, 1858

134 ROBERT HOWLETT. I. K. Brunel, designer of the steamship *Great Eastern*, before the ship's launching, November 1857

135 P. H. DELAMOTTE. Opening by Queen Victoria of the rebuilt Crystal Palace at Sydenham, 10 June 1854

136 P. H. DELAMOTTE. The visit of Napoleon III and Empress Eugénie with Queen Victoria and Prince Albert to the Crystal Palace, 20 April 1855





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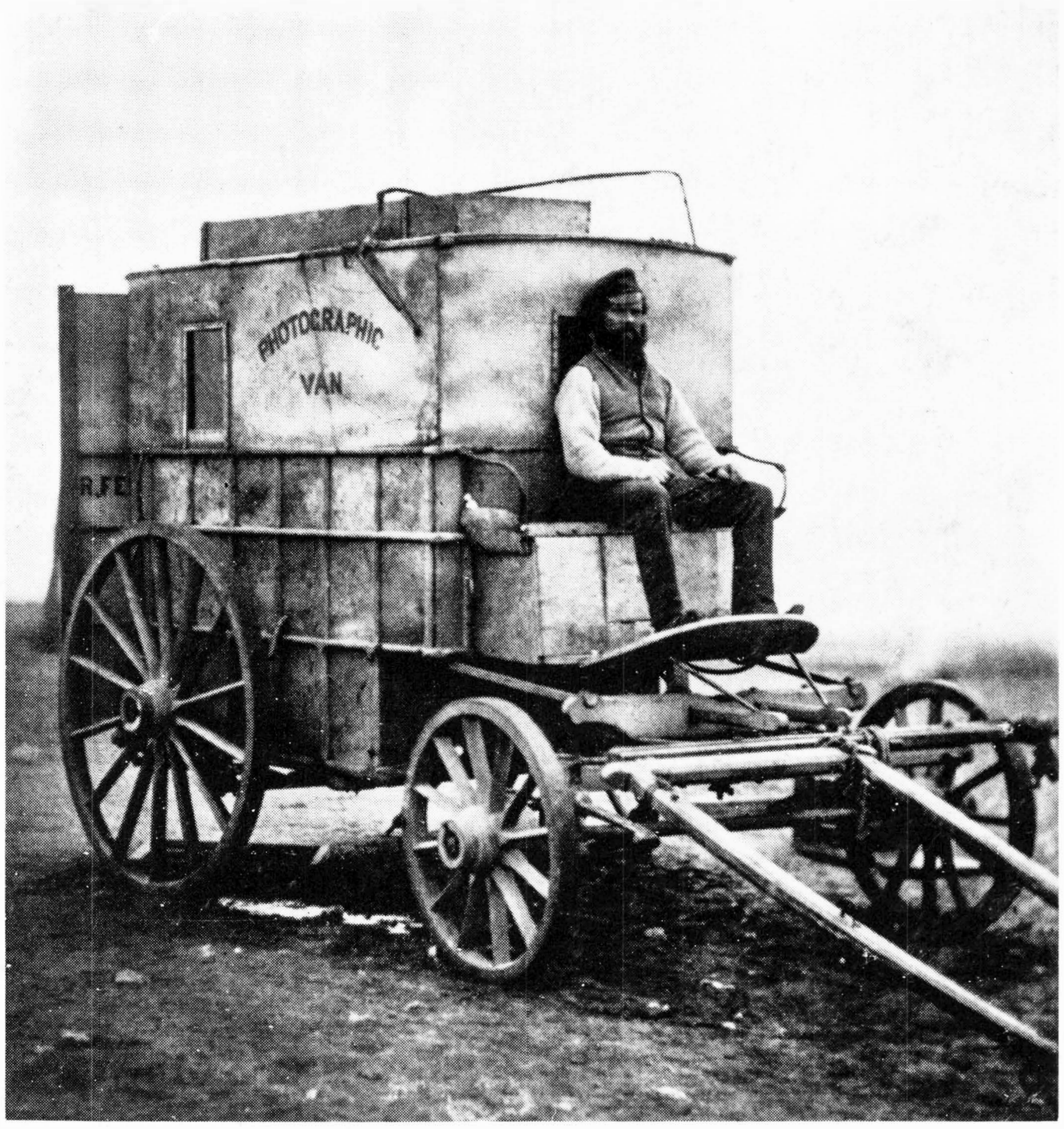
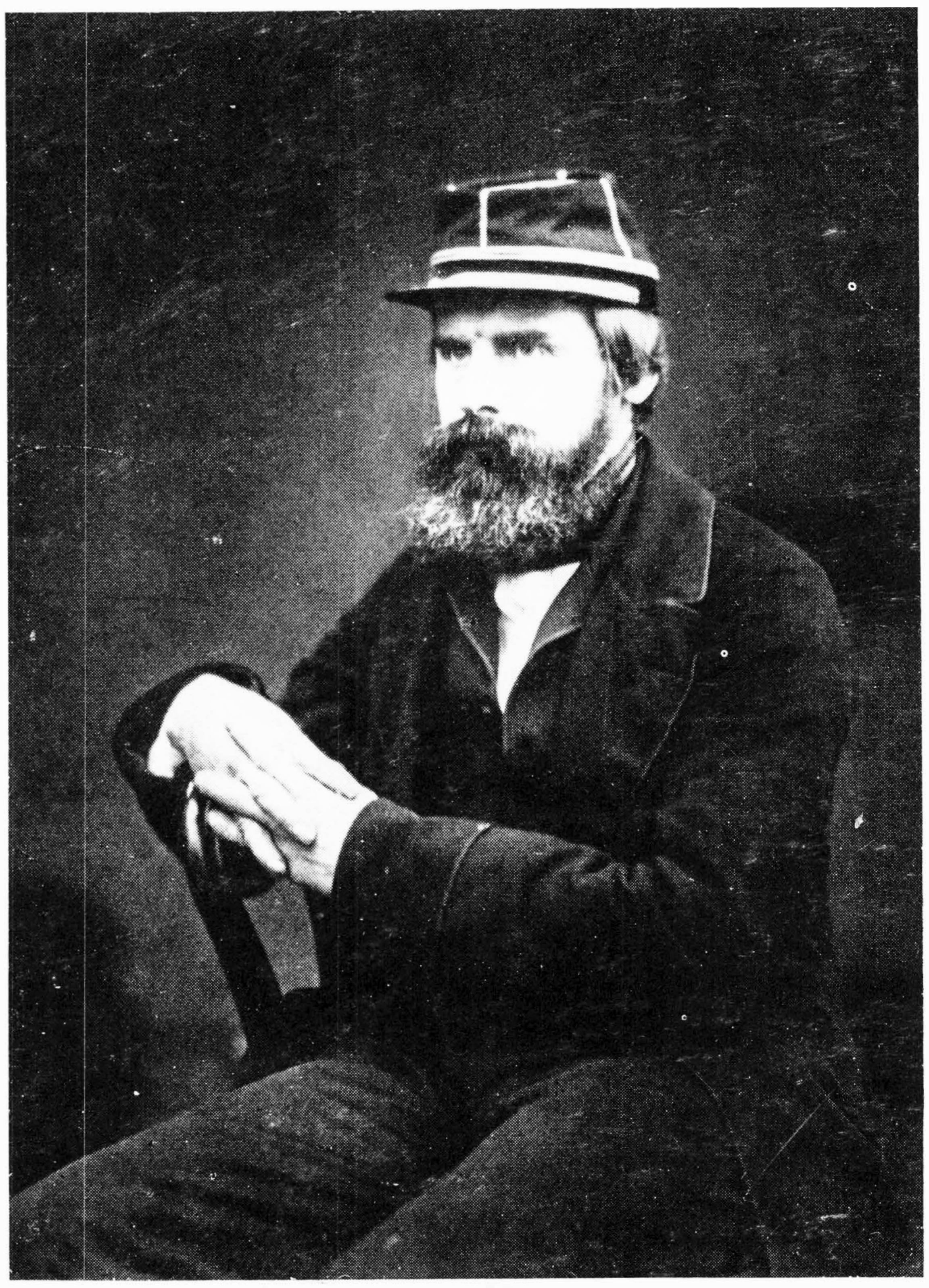




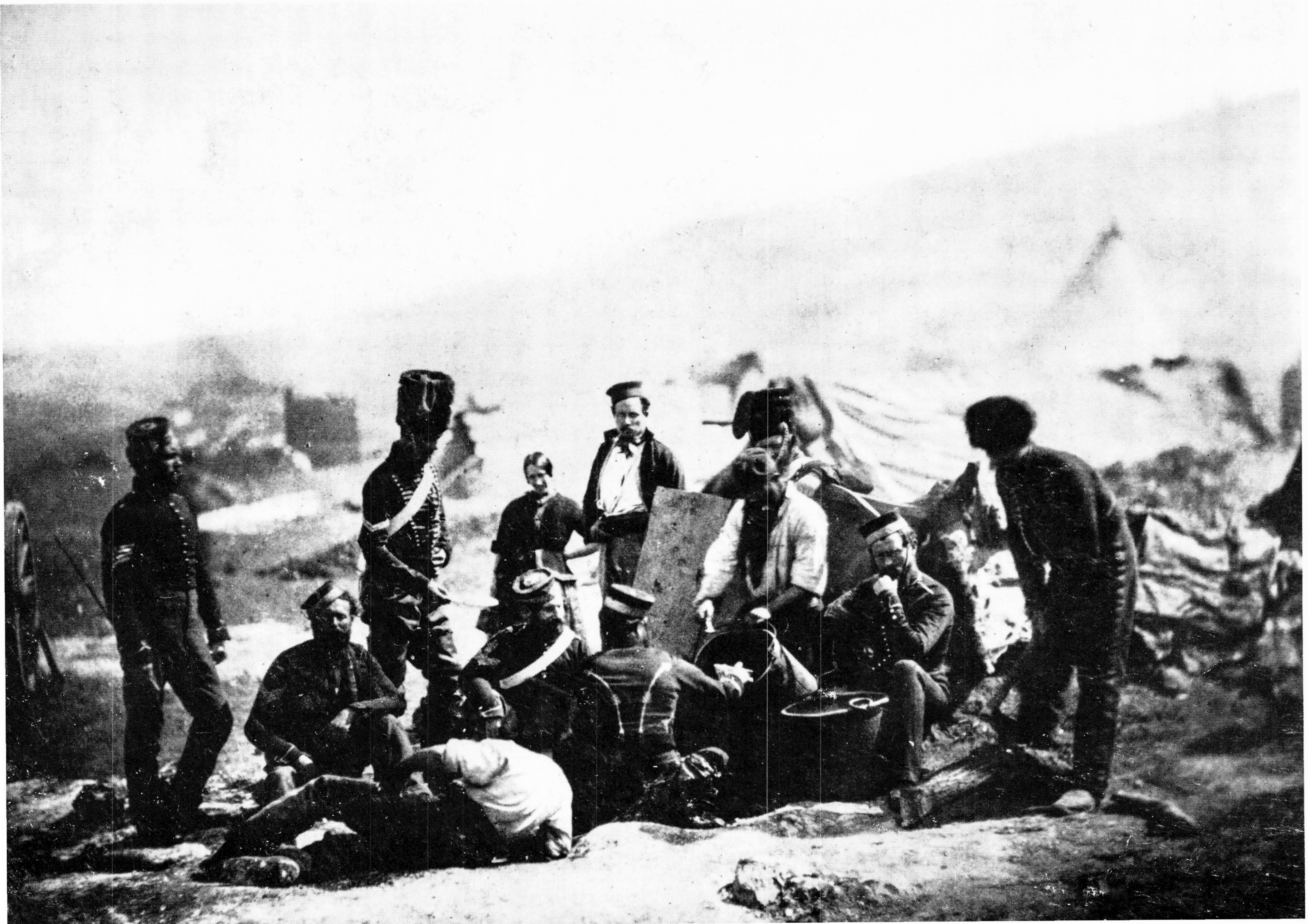
137 ROGER FENTON's photographic van, 1855

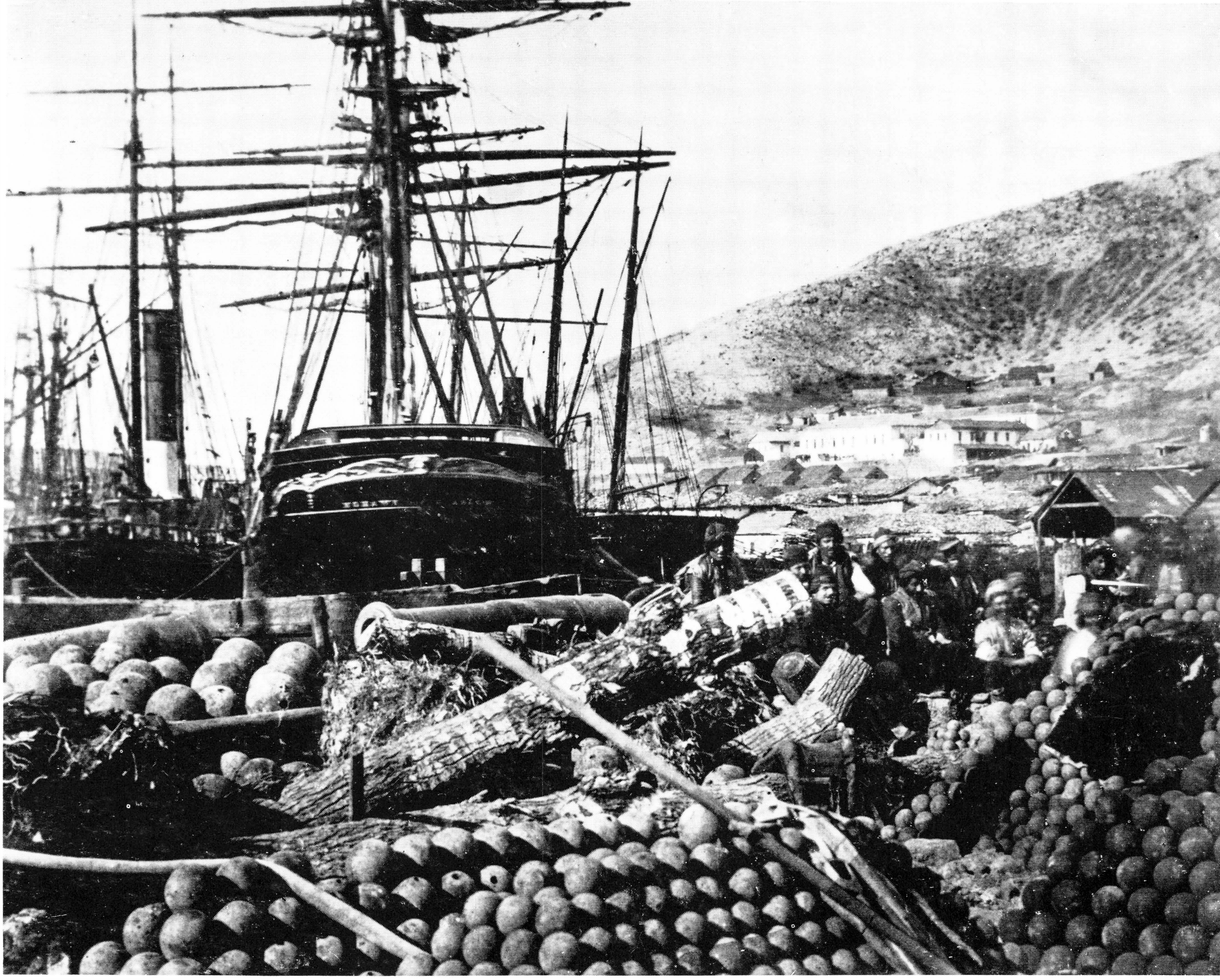
138 ROGER FENTON, photograph by DR DIAMOND, *c.* 1855

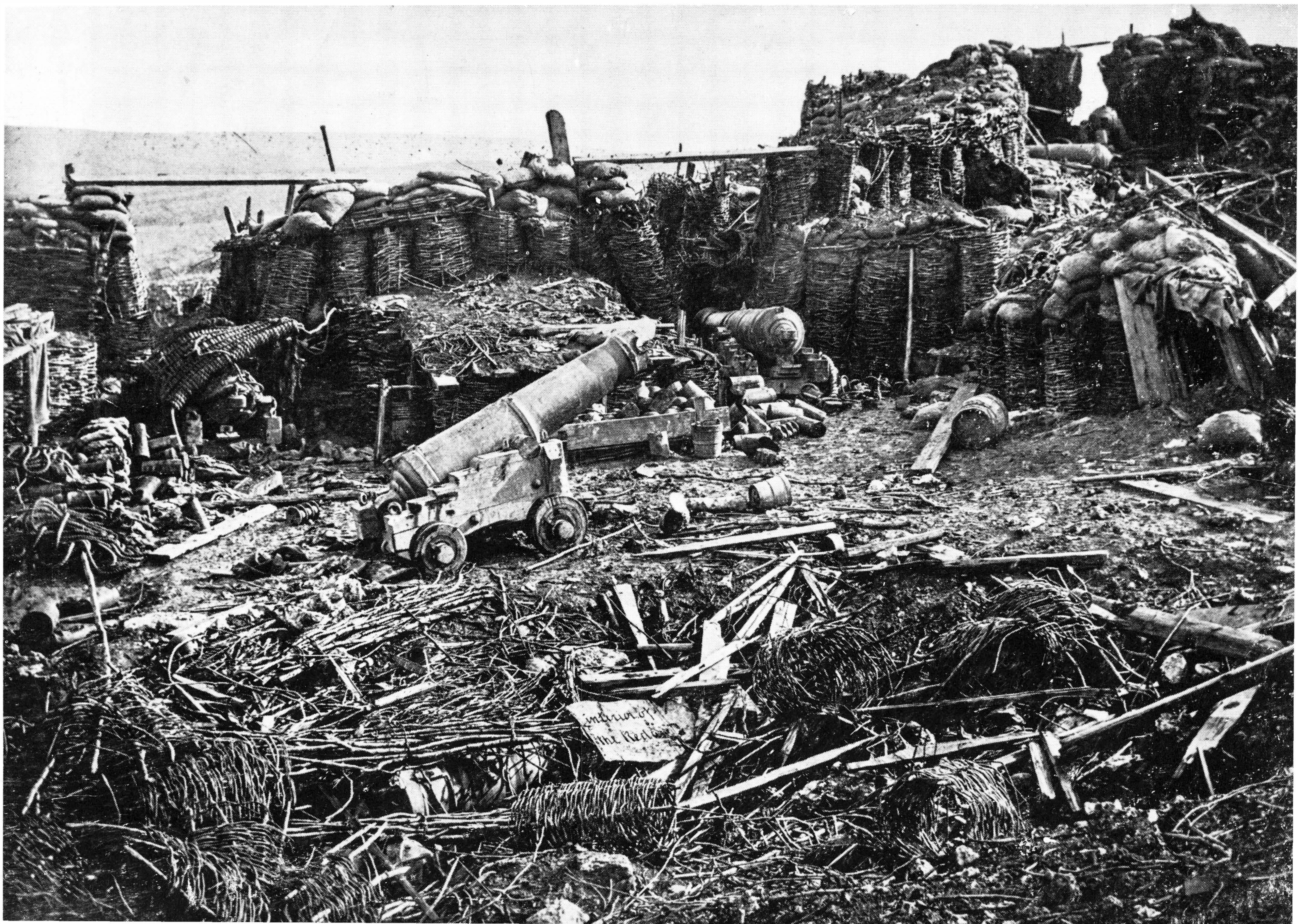
139 ROGER FENTON. 'The Cookhouse of the 8th Hussars', 1855

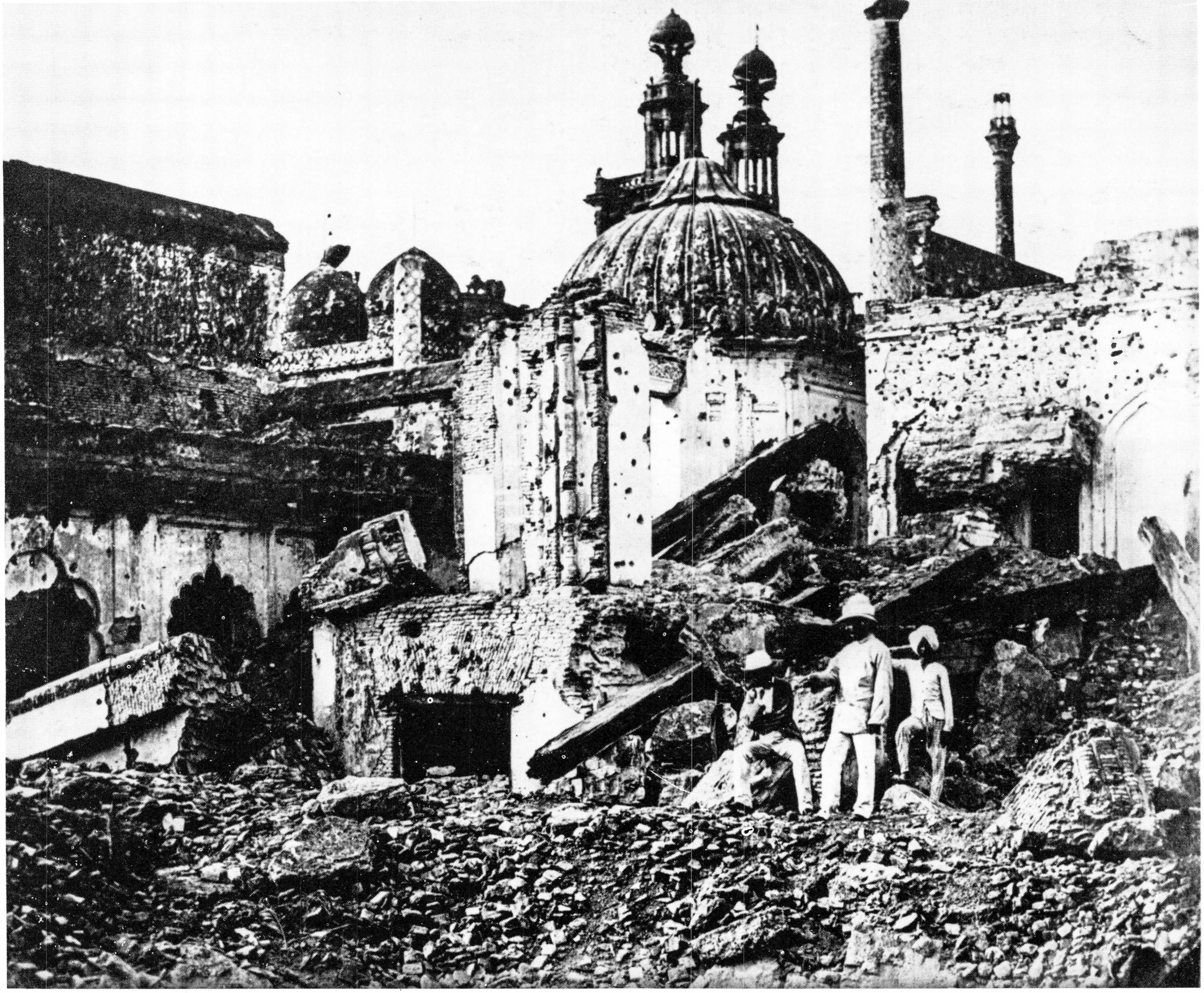
140 ROGER FENTON. Ordnance wharf, Balaclava. Crimean War, 1855

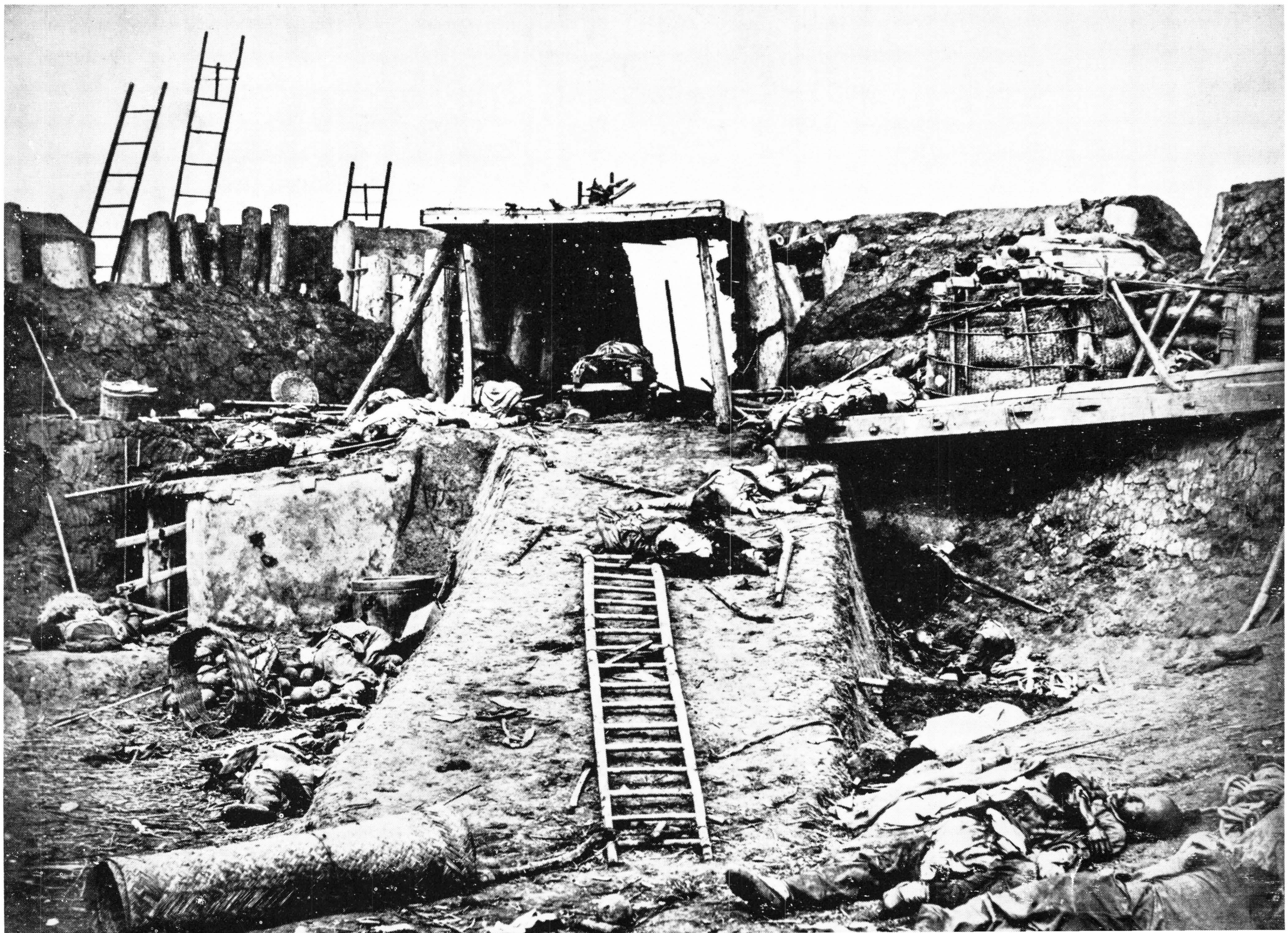
141 JAMES ROBERTSON. Interior of the Redan, September 1855

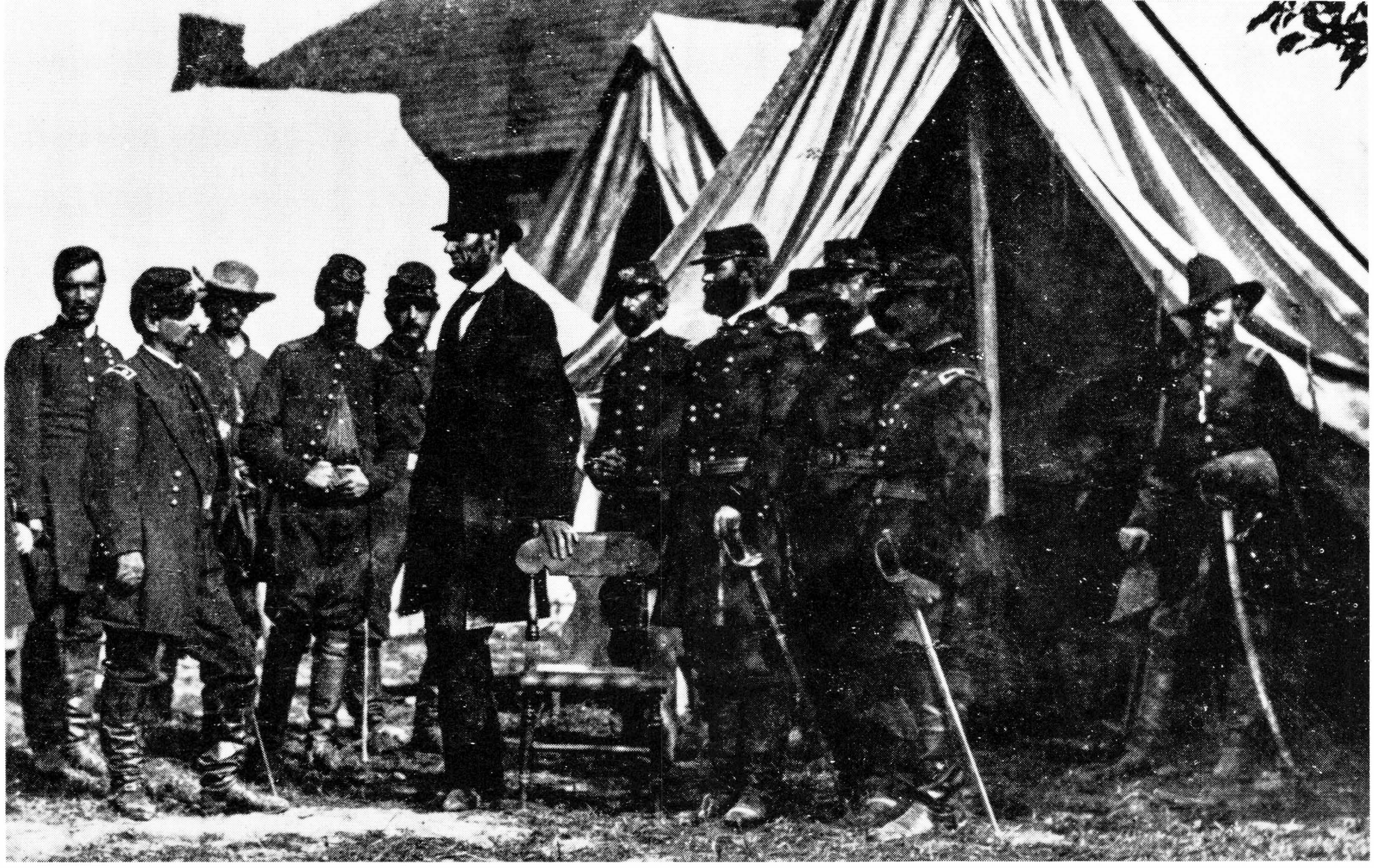





interior of
the Redan







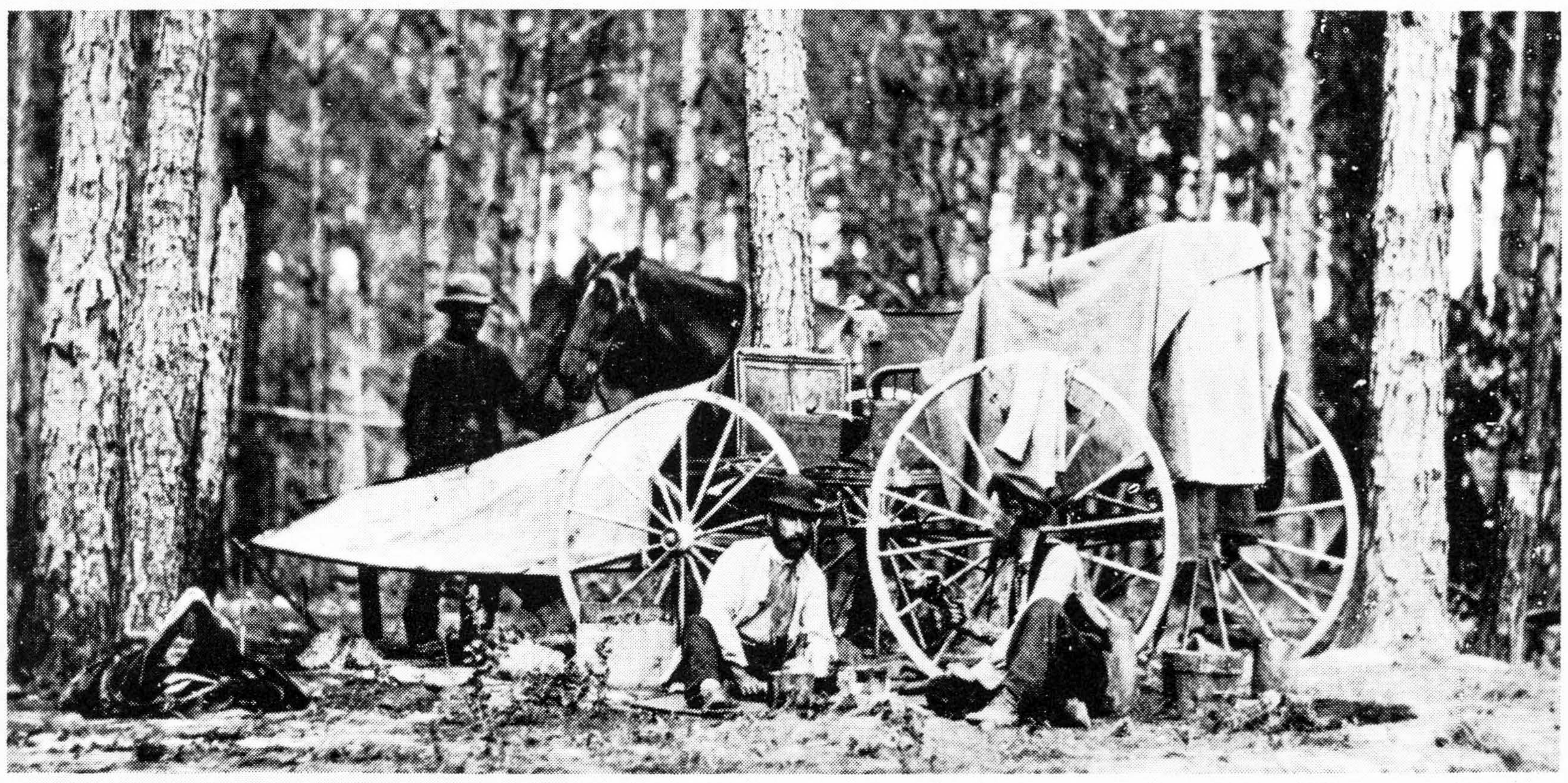
142 FELICE A. BEATO. The Chatter Manzil Palace, Lucknow, after its destruction in the Indian Mutiny, September 1857

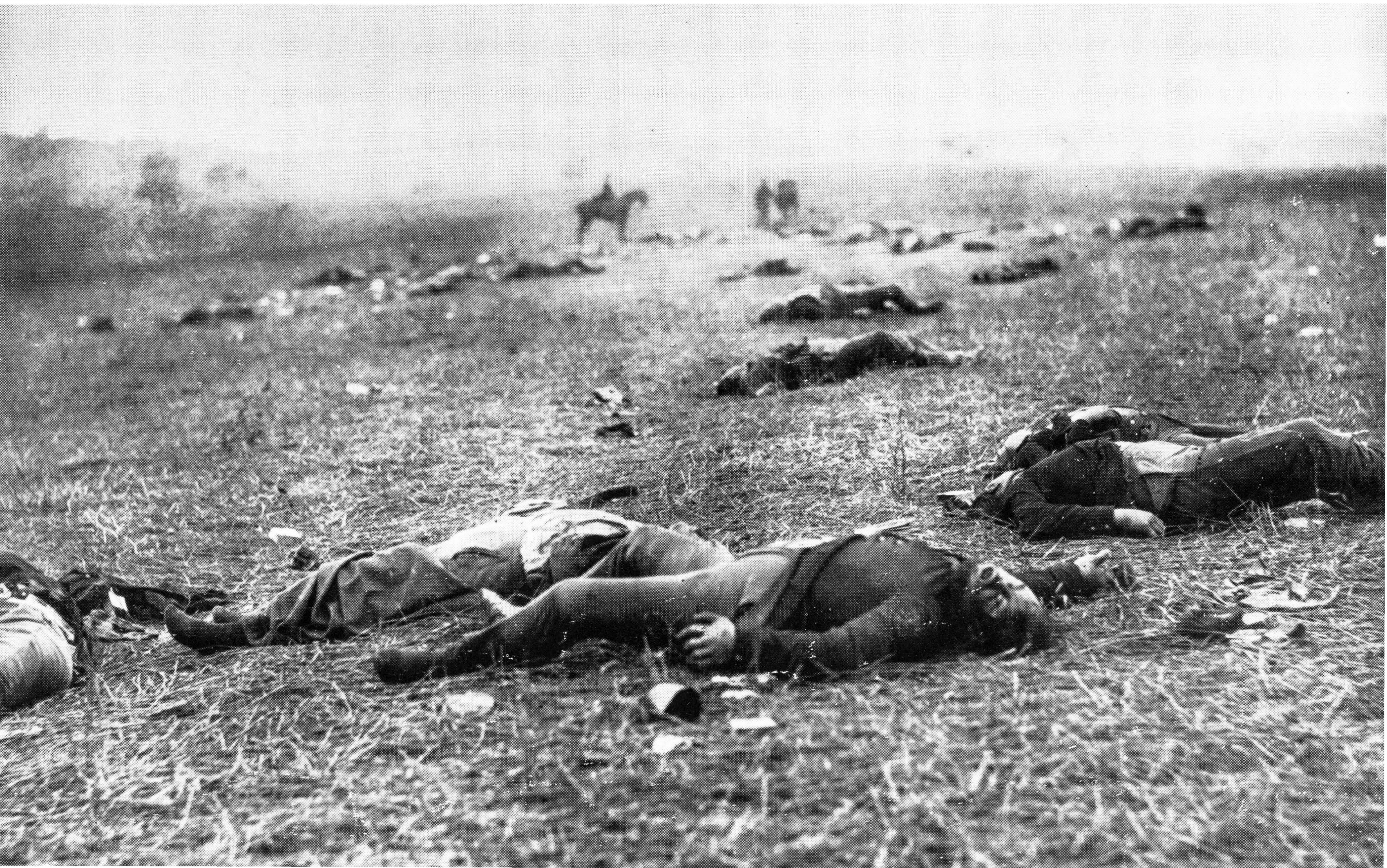
143 FELICE A. BEATO. The capture of Fort Taku in north China, 1860

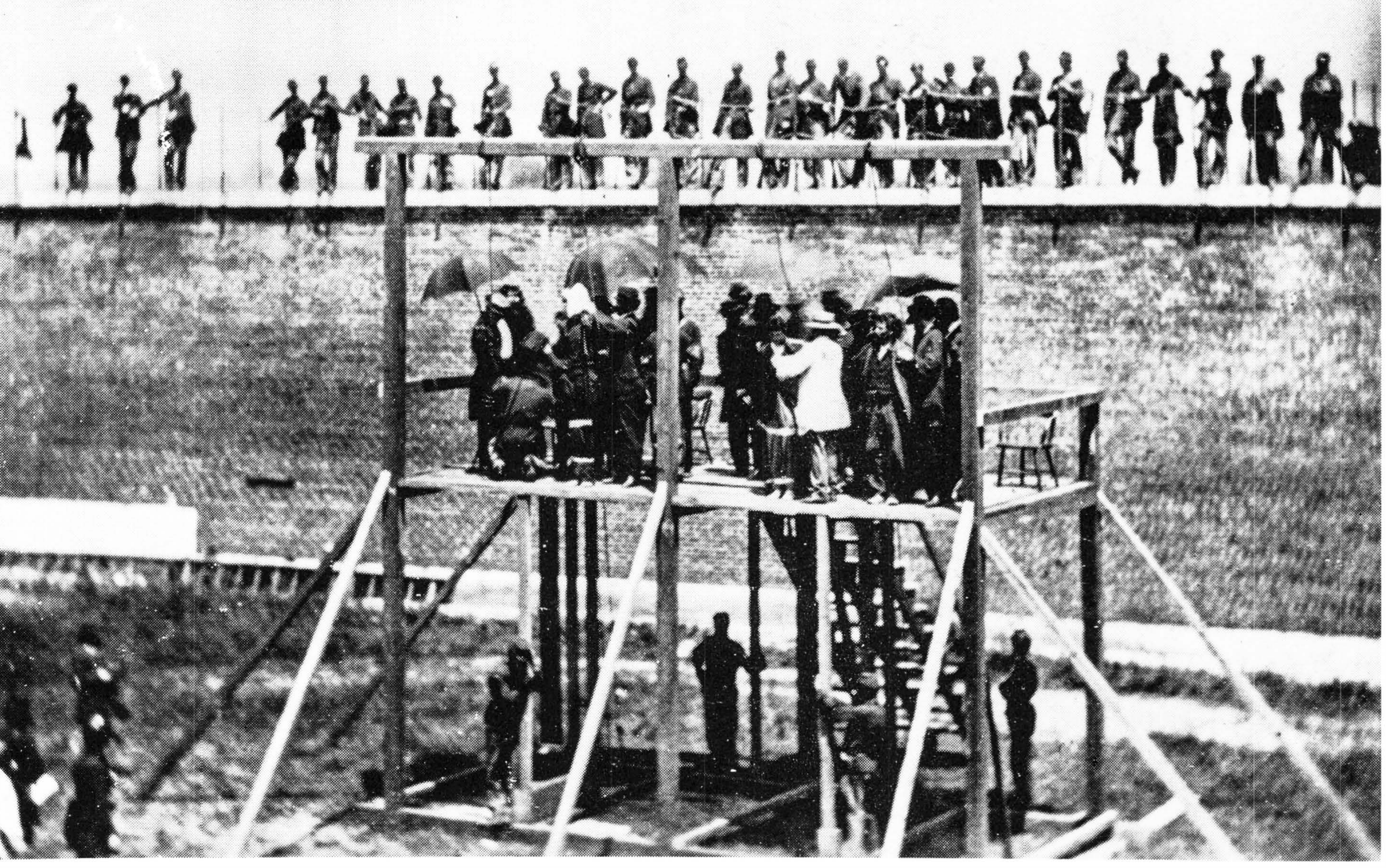
144 ALEXANDER GARDNER. President Lincoln visiting the Army of the Potomac, 1 October 1862

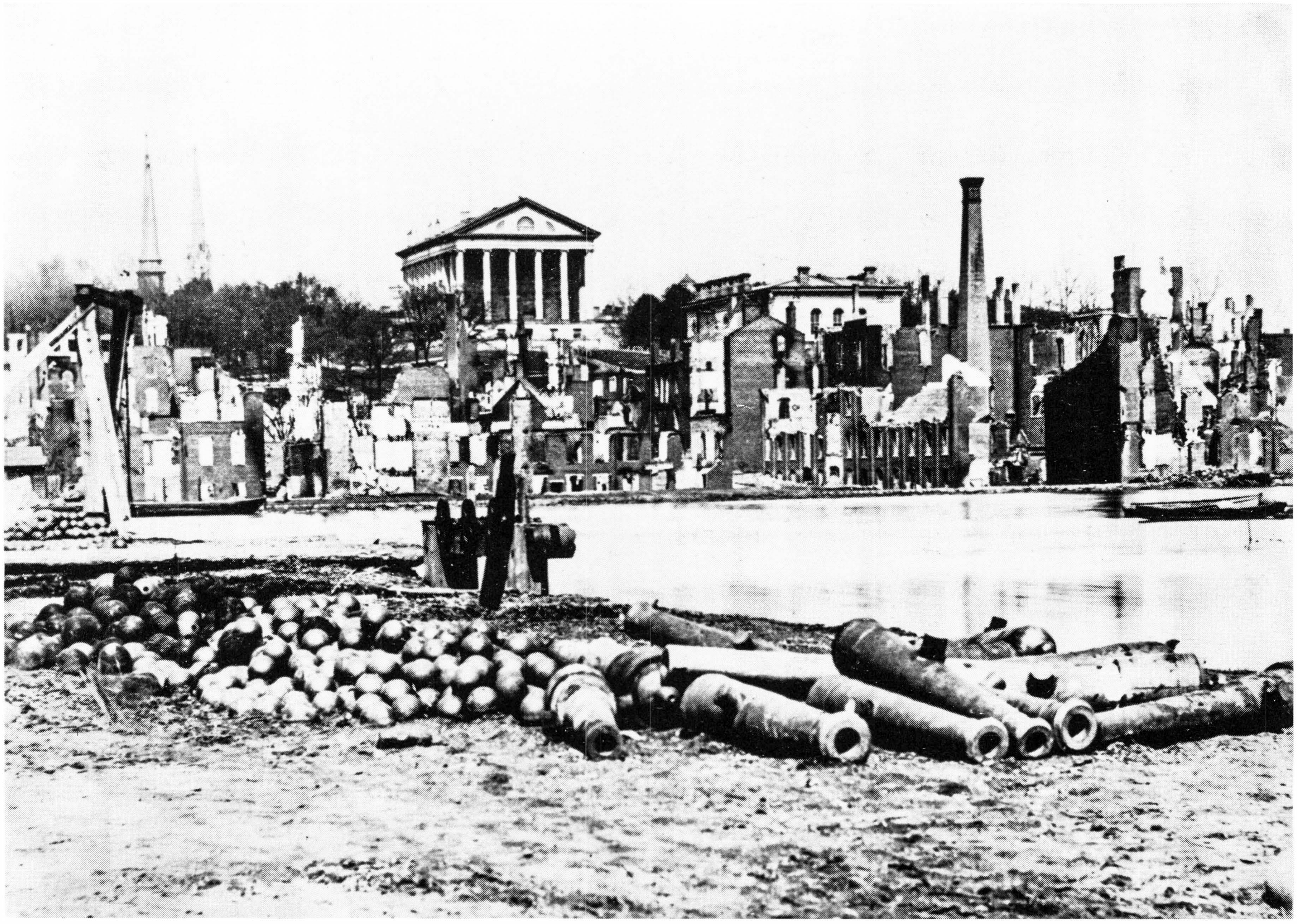
145 MATHEW B. BRADY's photographic van at Petersburg, Va, *c.* 1864

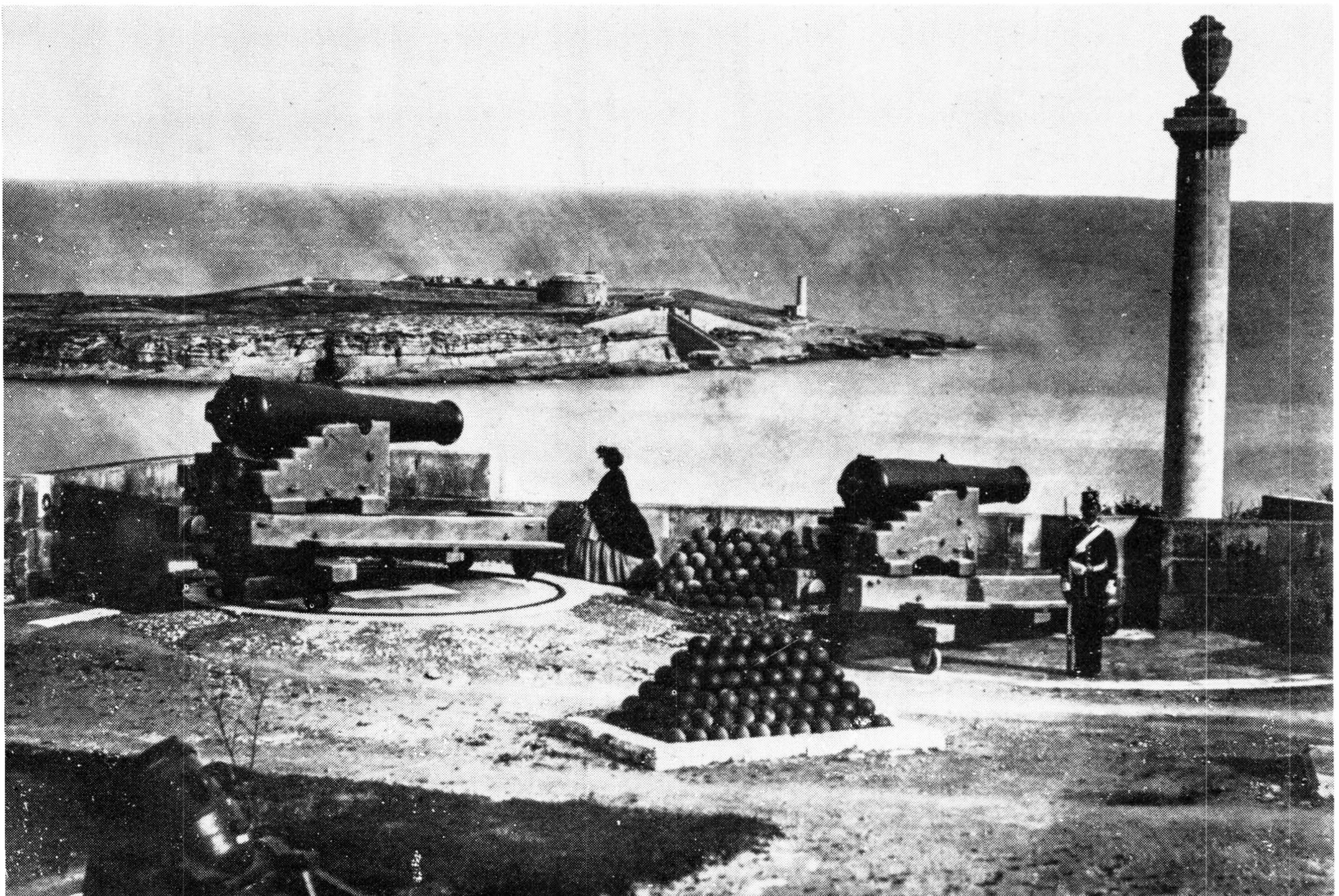
146 T. H. O'SULLIVAN. 'The Harvest of Death'. The battlefield of Gettysburg, July 1863











147 ALEXANDER GARDNER. The execution of conspirators against President Lincoln, 7 July 1865

148 MATHEW B. BRADY. The ruins of Richmond, Va, April 1865

149 JAMES ROBERTSON(?). The fortress, Malta, *c.* 1860

150 Unknown photographer. Wrecked German troop train near Mézières. Franco-Prussian War, 1870

151 Unknown photographer. The statue of Napoleon I on the Vendôme Column after being pulled down by Communards, 16 May 1871. The group includes Gustave Courbet (marked with cross)

152 Unknown photographer. Bodies of unidentified Communards, May 1871

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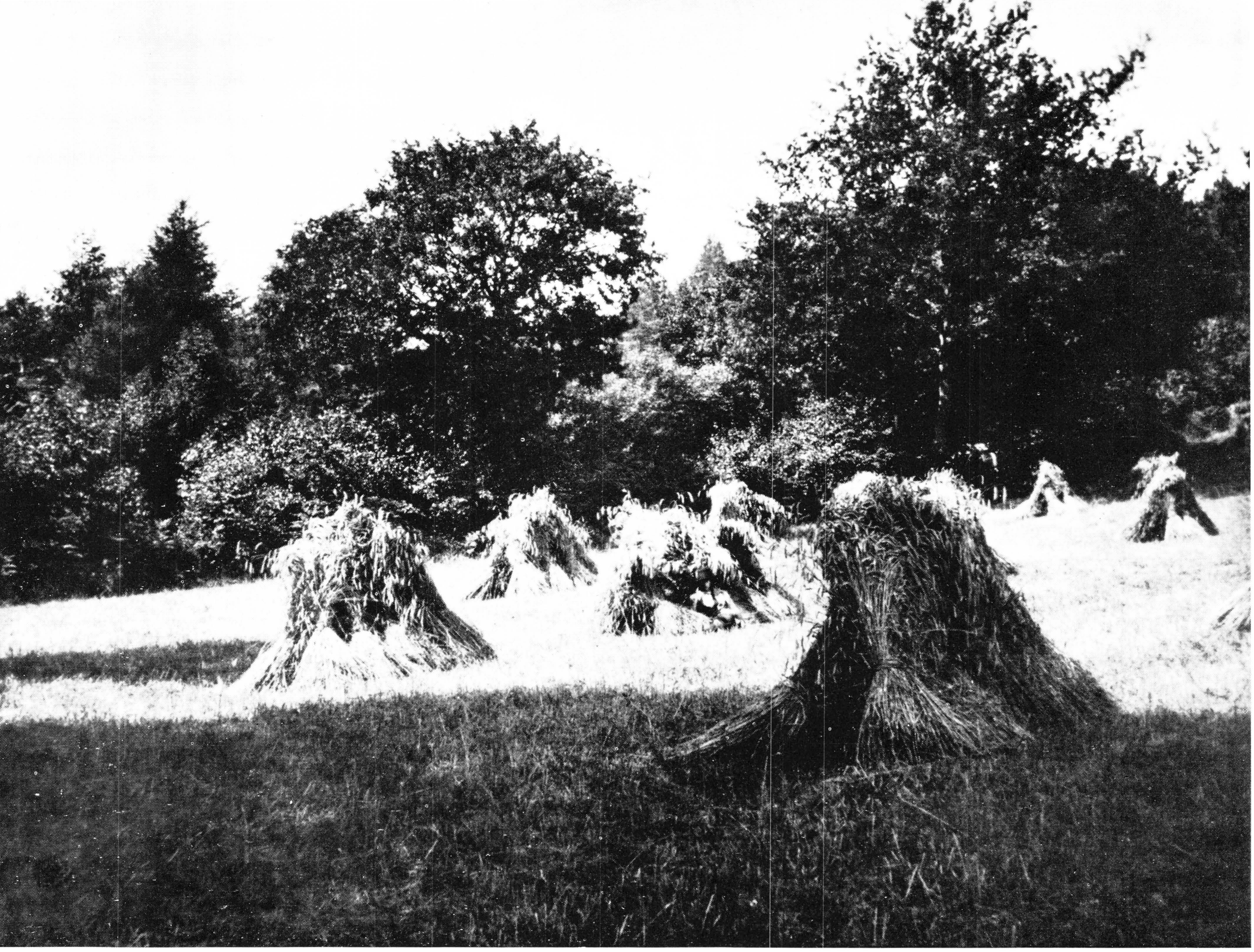
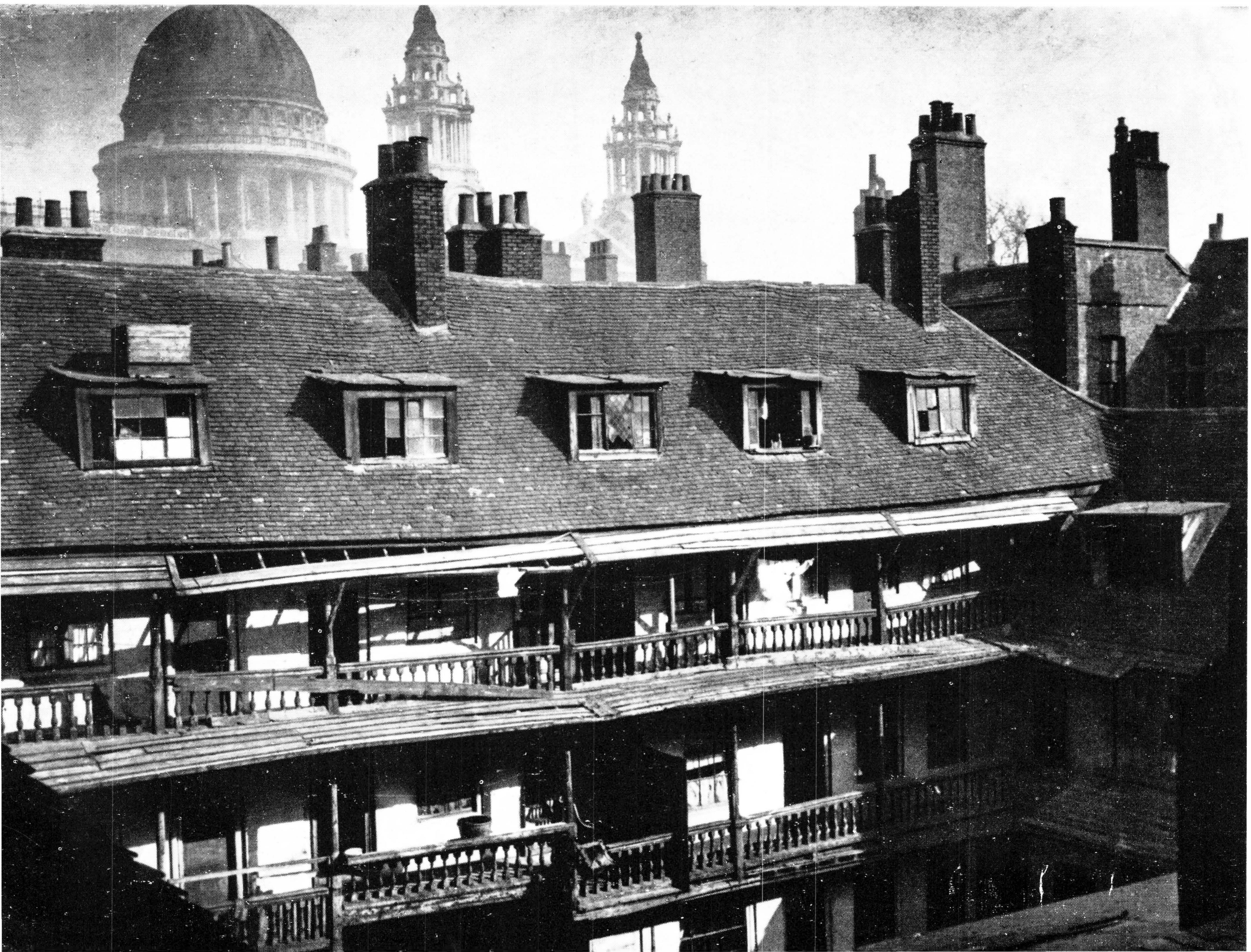
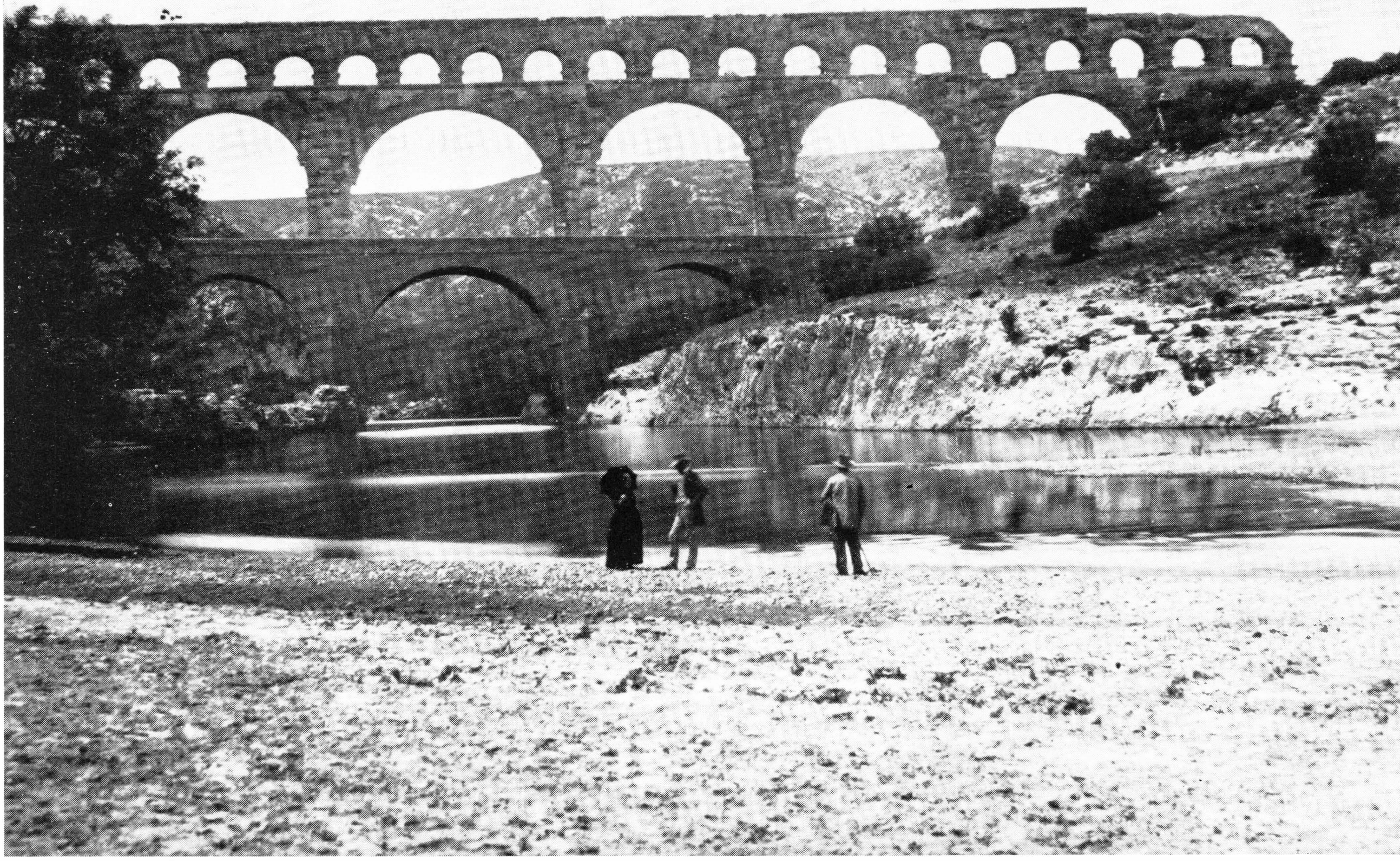


153 HENRY WHITE. A cornfield, 1856

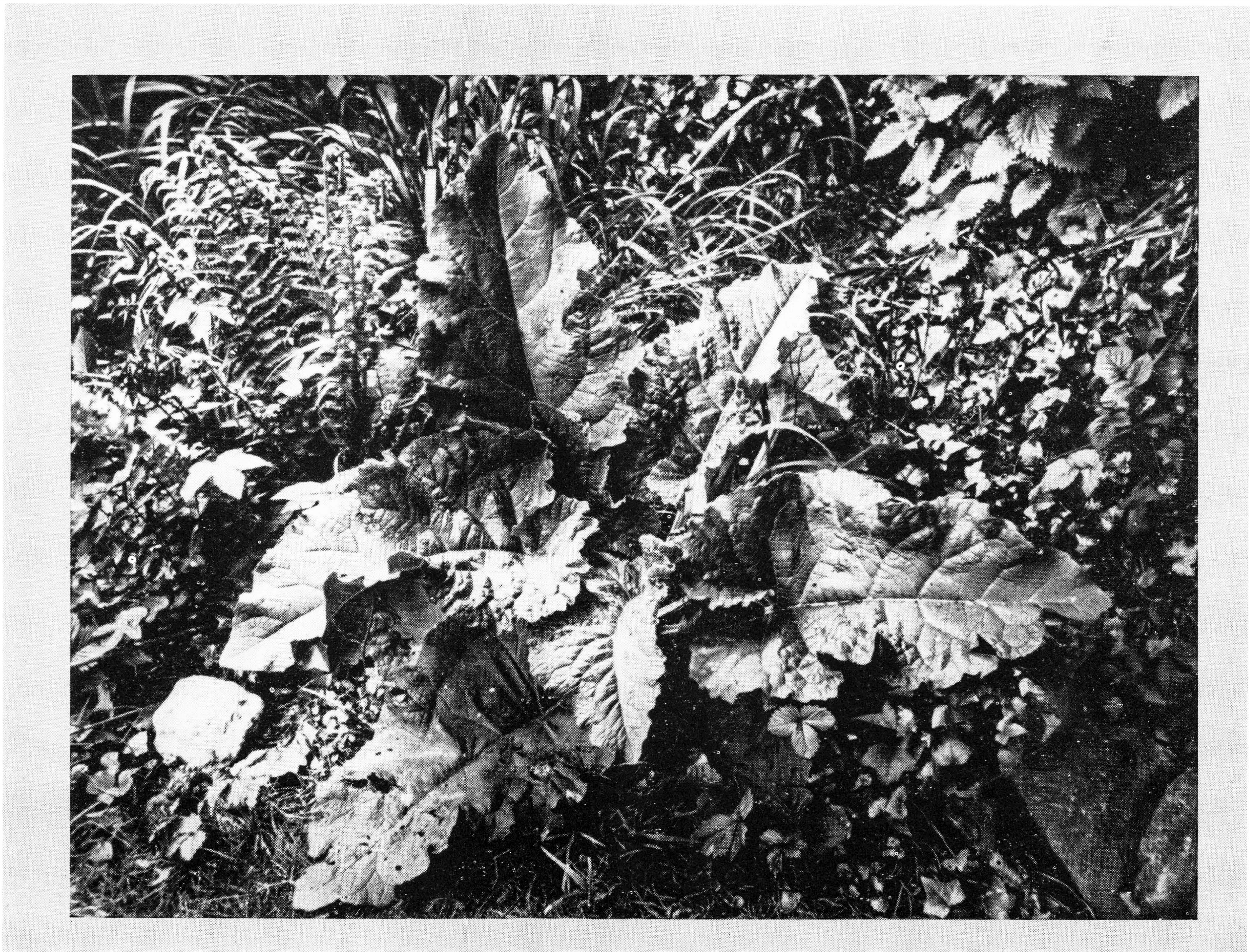
154 HENRY DIXON. The Oxford Arms, Warwick Lane. Carbon print, 1877

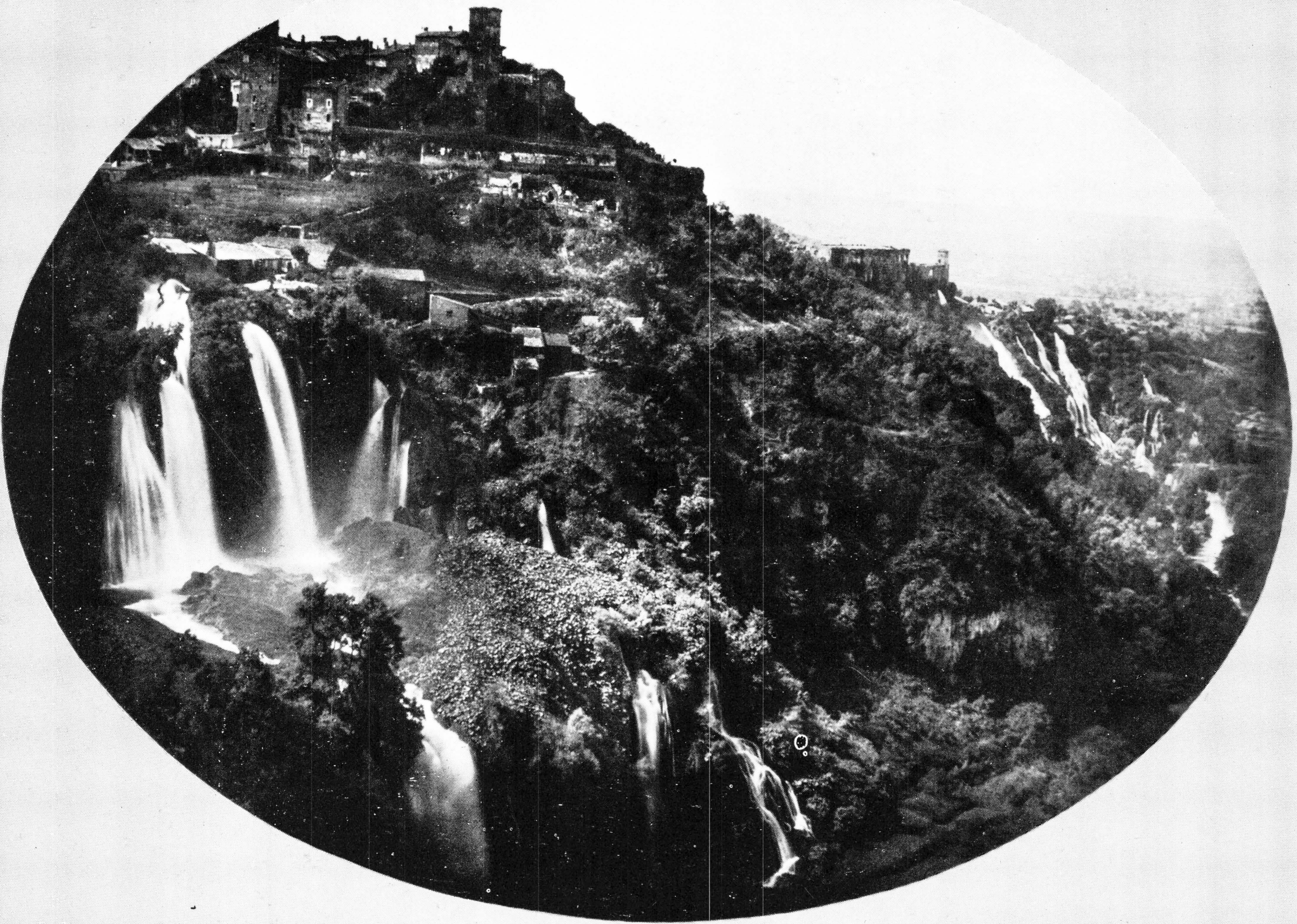


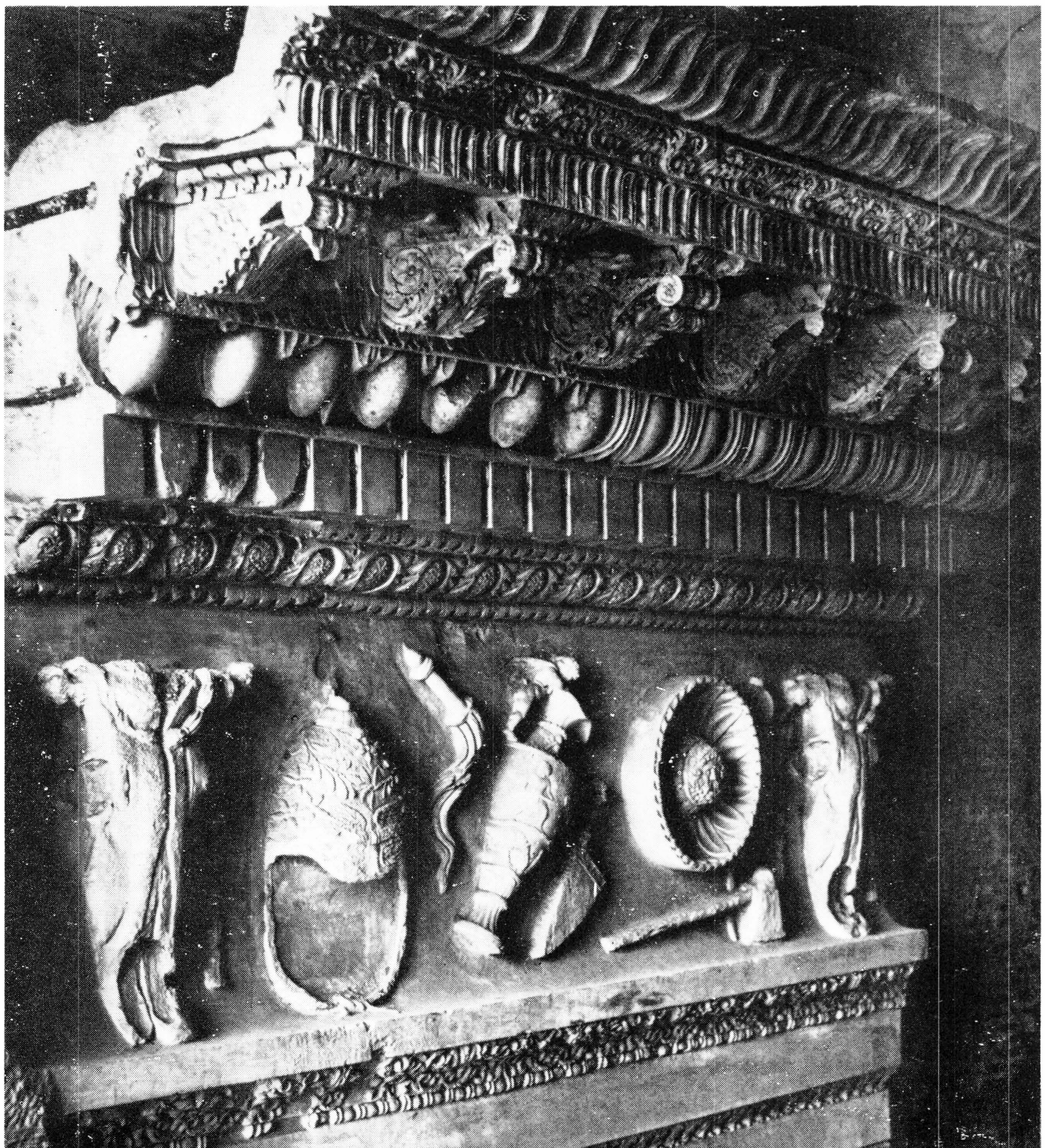


155 E. BALDUS. The Pont du Gard, near Nîmes, *c.* 1855

156 Royal Engineers, Chatham Military School. Study of plants, *c.* 1860



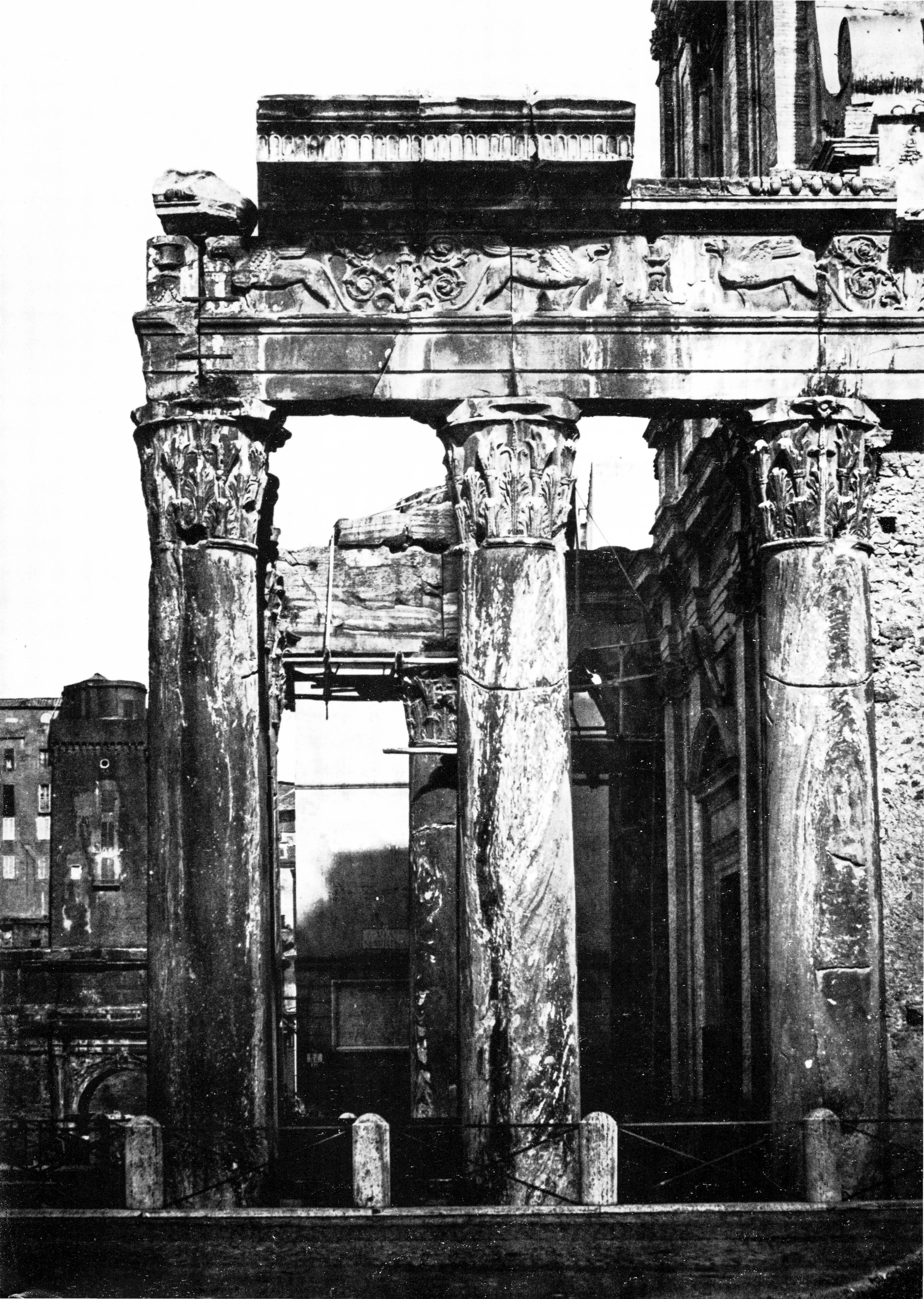


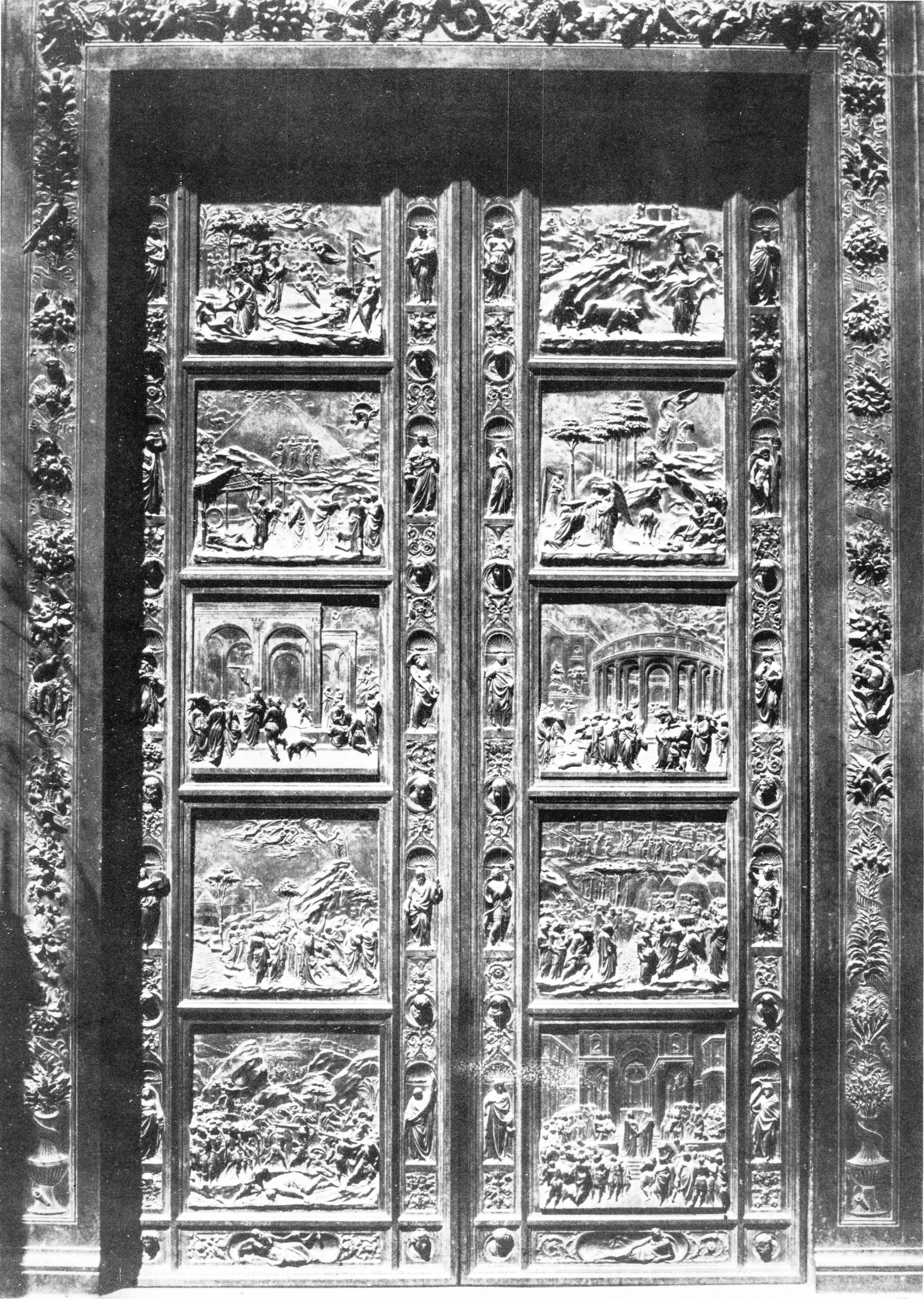


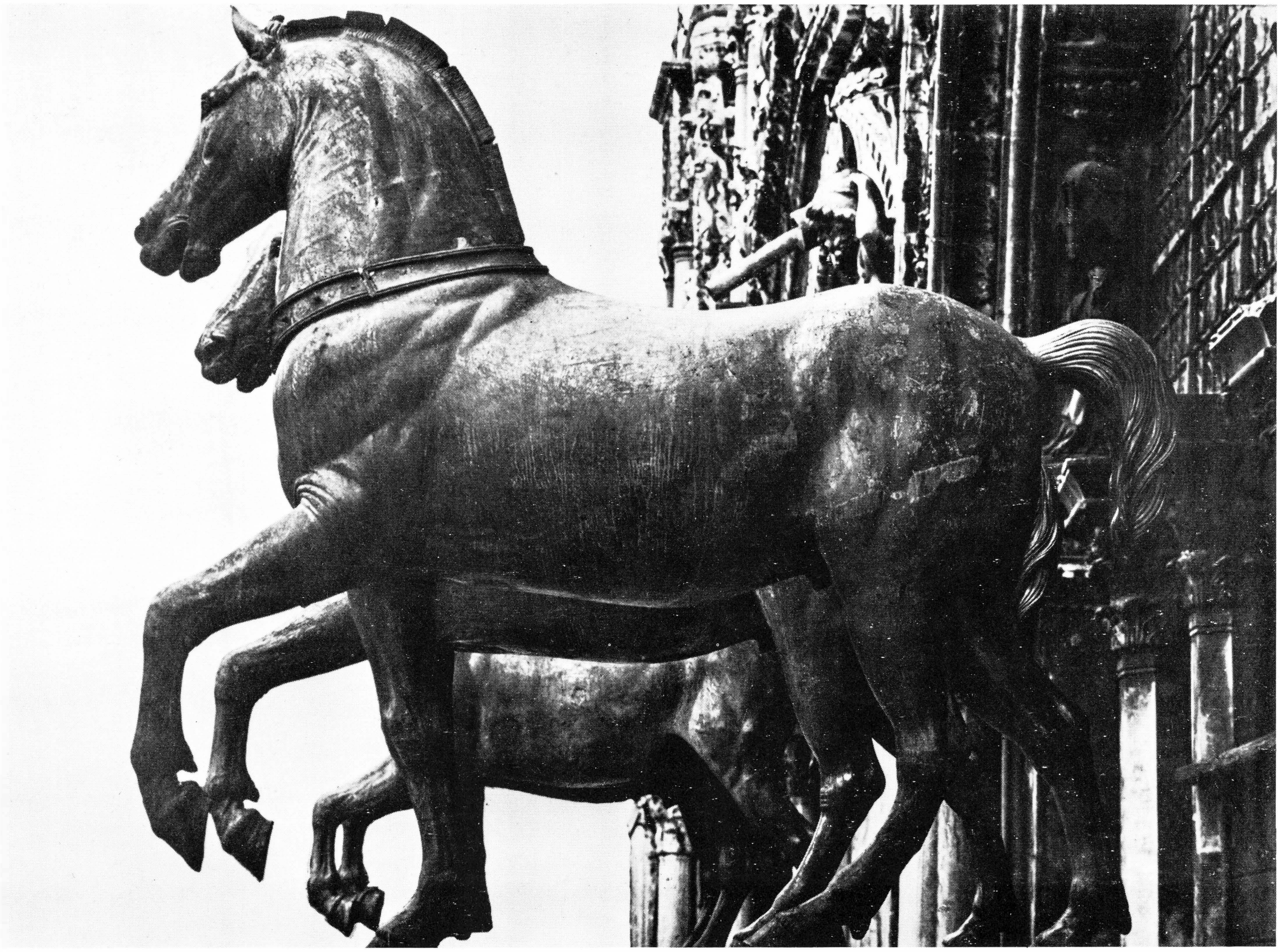
157 ROBERT MACPHERSON. Cascades at Tivoli. Collodio-albumen, 1857

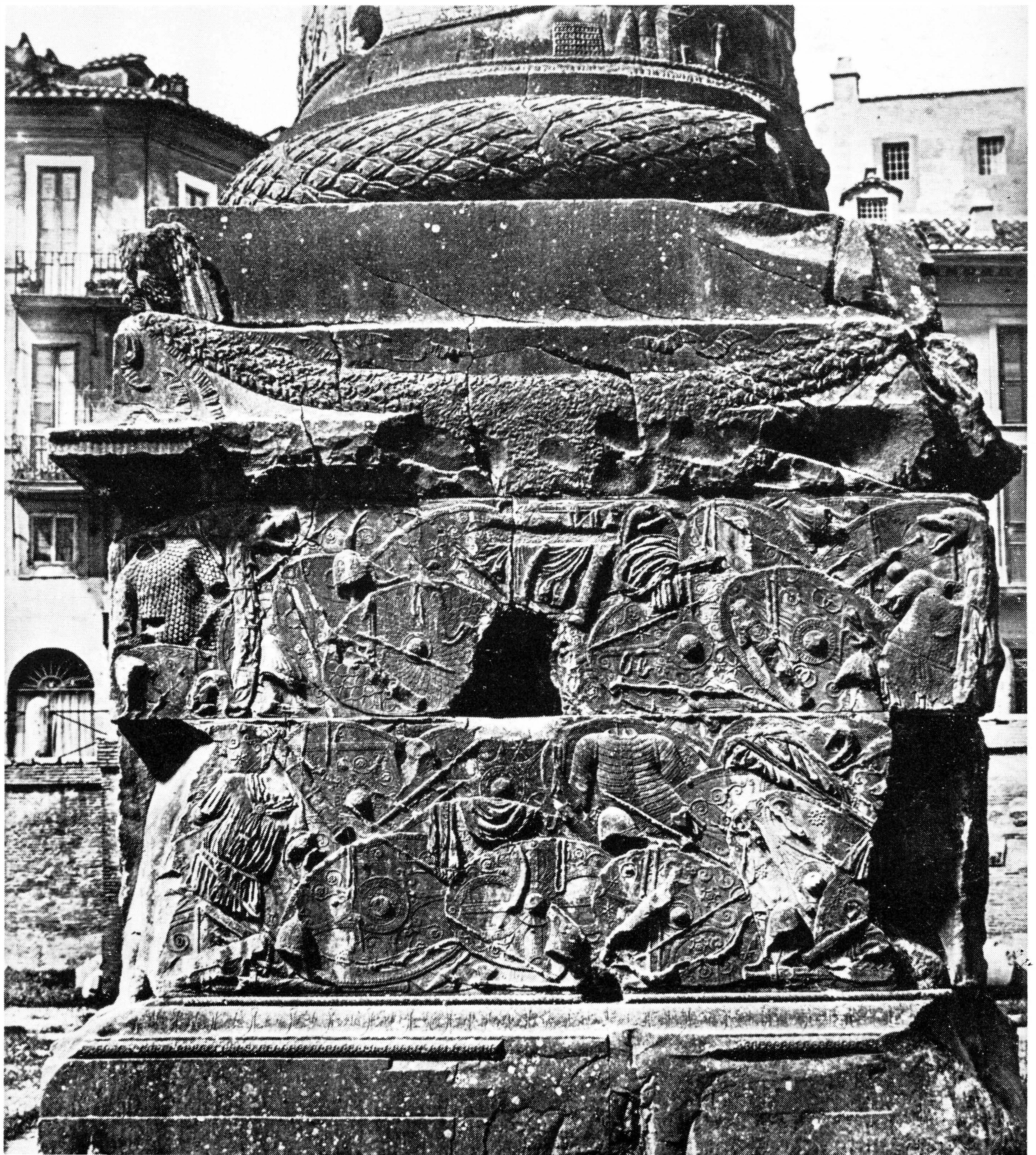
158 AUGUSTE AND LOUIS BISSON. Temple of Vespasian, Rome, detail of architrave, 1858

159 ROBERT MACPHERSON. Temple of Antoninus Pius and Faustina, Rome. Collodio-albumen, *c.* 1857





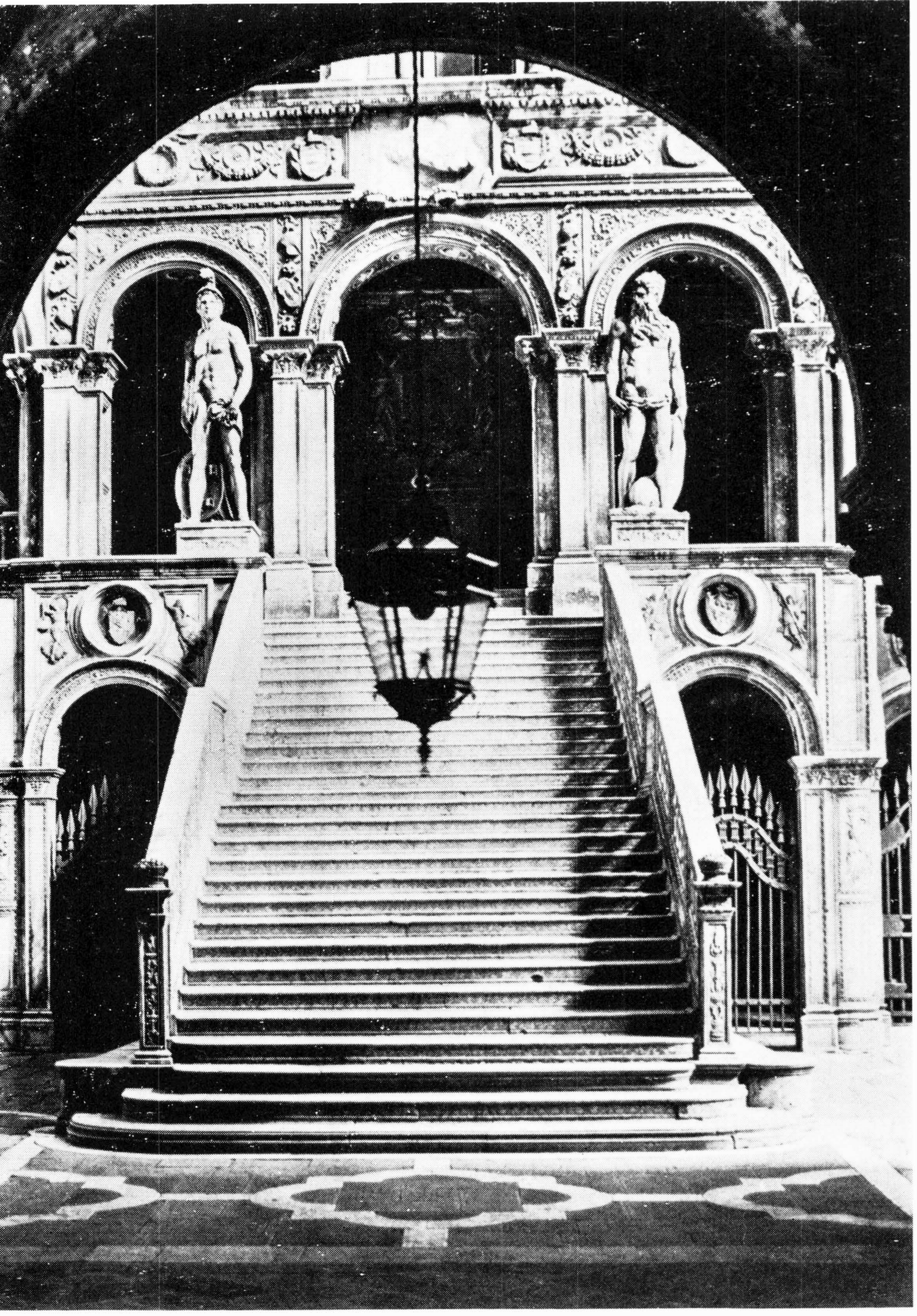




160 LEOPOLDO AND GIUSEPPE ALINARI. The Baptistry, Florence, one of Ghiberti's bronze doors, *c.* 1855

161 CARLO PONTI. Greek bronze horses, Basilica di San Marco, Venice, *c.* 1860

162 JAMES ANDERSON. Base of Trajan's Column, Rome, *c.* 1858



163 CARLO PONTI. Courtyard of the Doge's Palace, Venice, 1862

164 CARLO PONTI. Piazza San Marco, Venice, *c.* 1862

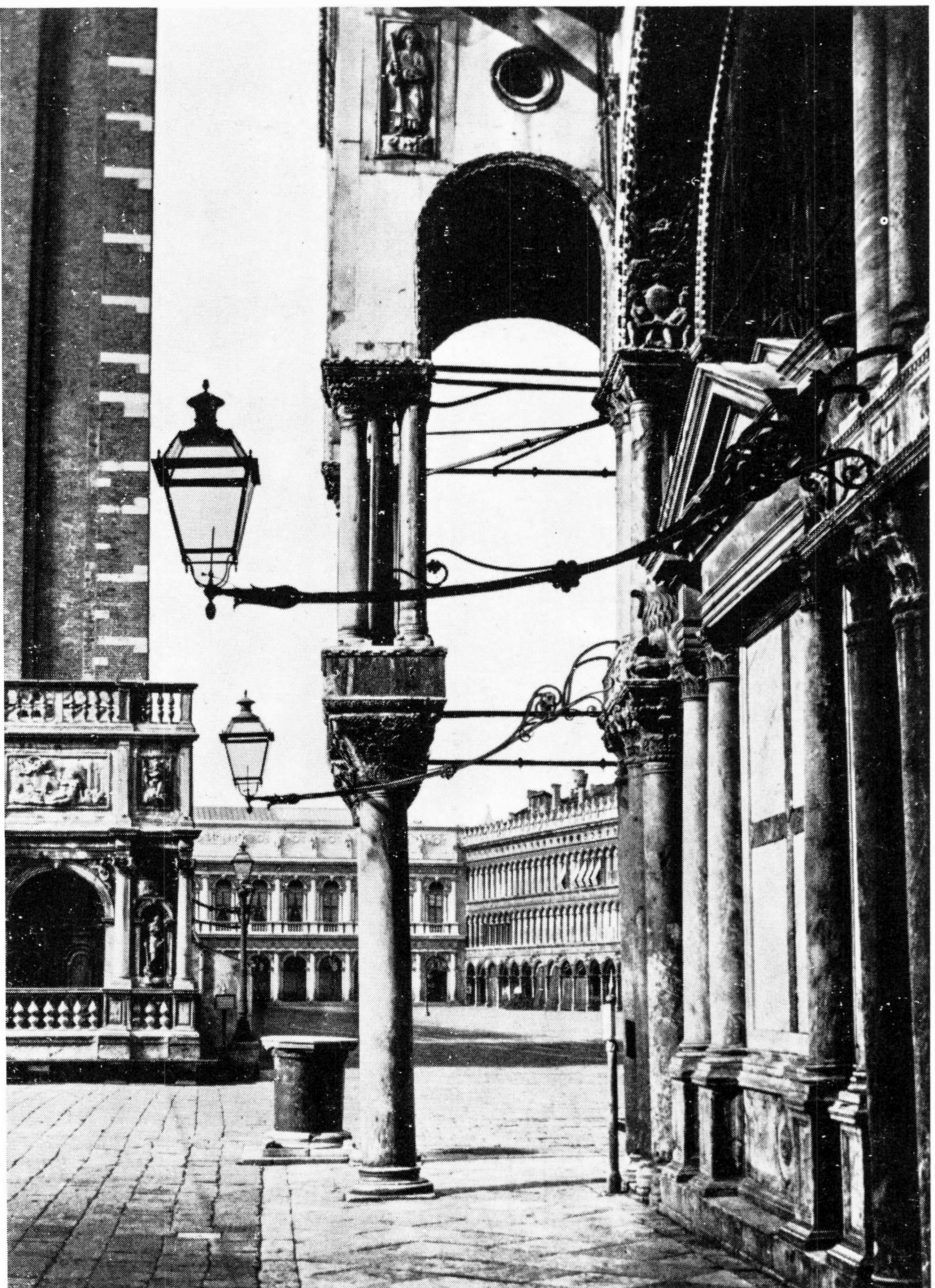
165 FRANCIS FRITH. Title-page of *The Gossiping Photographer at Hastings*, with portraits of the author in his double role as photographer and writer, 1864

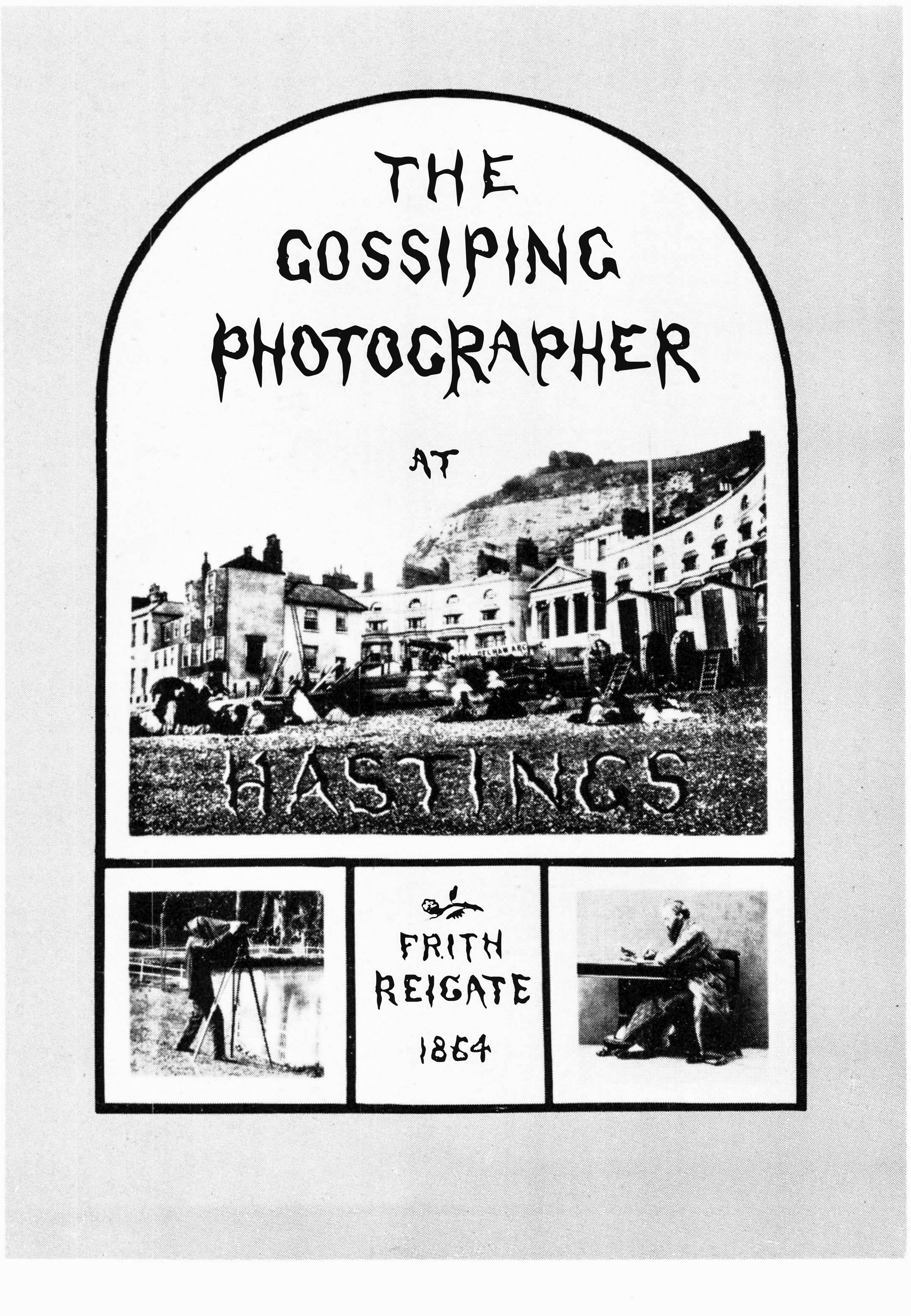
166 CHARLES CLIFFORD. Palace del Infantado at Guadalajara, 1855

167 CHARLES CLIFFORD. Steps to the lake at Capricho Palace near Guadalajara, 1855

168 FRANCIS BEDFORD. Title-page of his *Tour in the East*, 1862

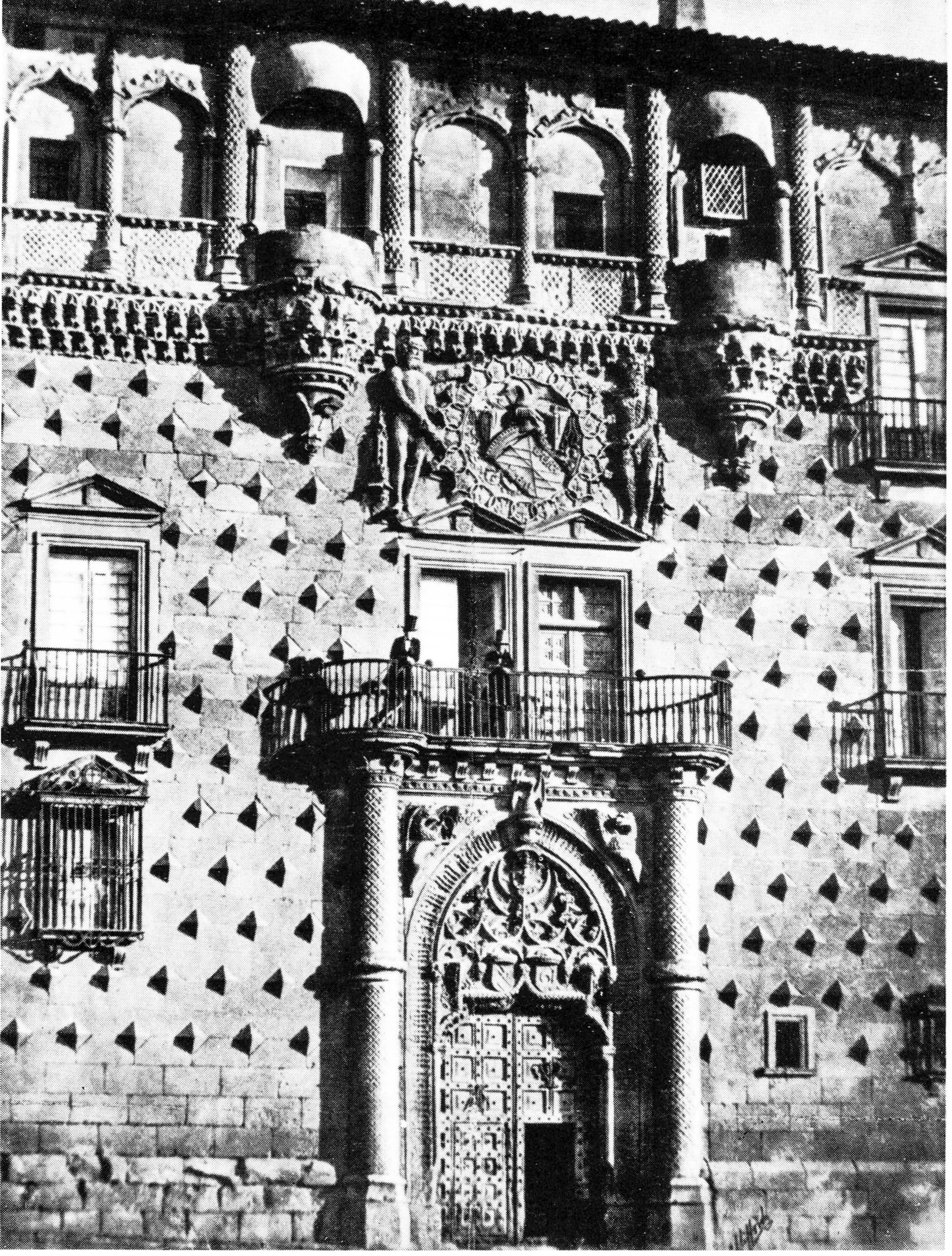
169 FRANCIS FRITH. Façade of the Temple of Rameses II at Abu Simbel, 1857

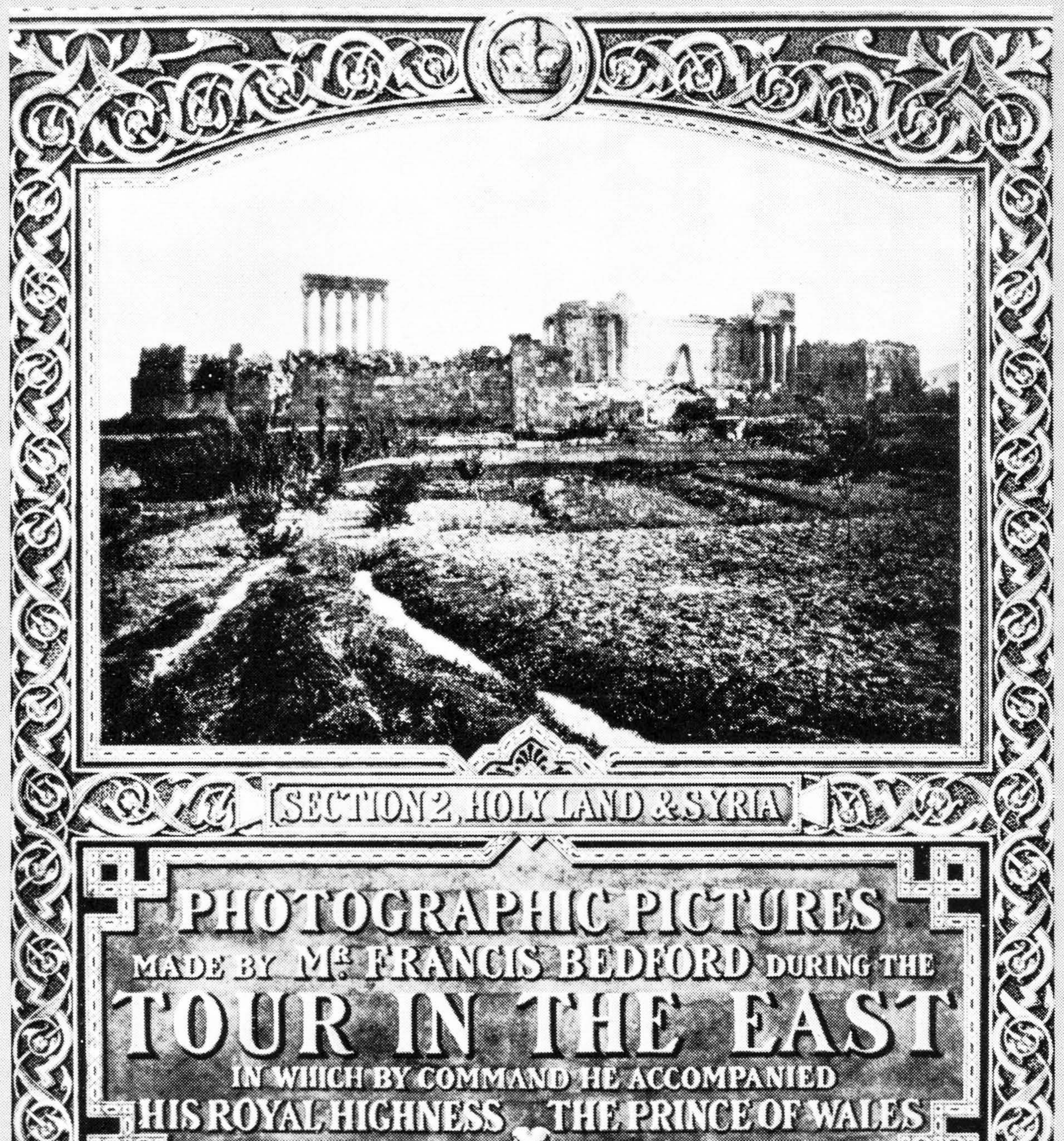




THE
GOSSIPING
PHOTOGRAPHER
AT
HASTINGS

FRITH
REIGATE
1864

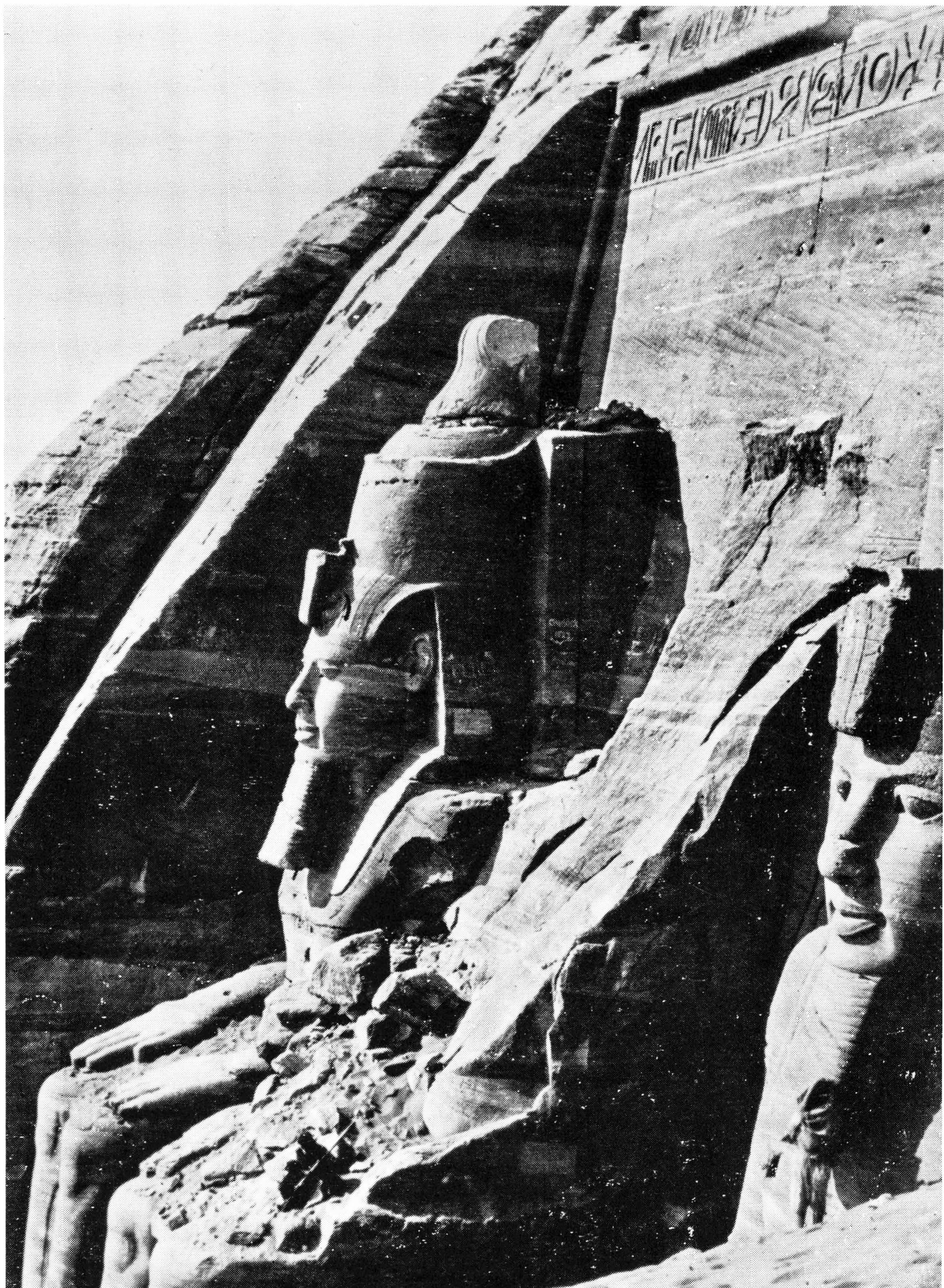


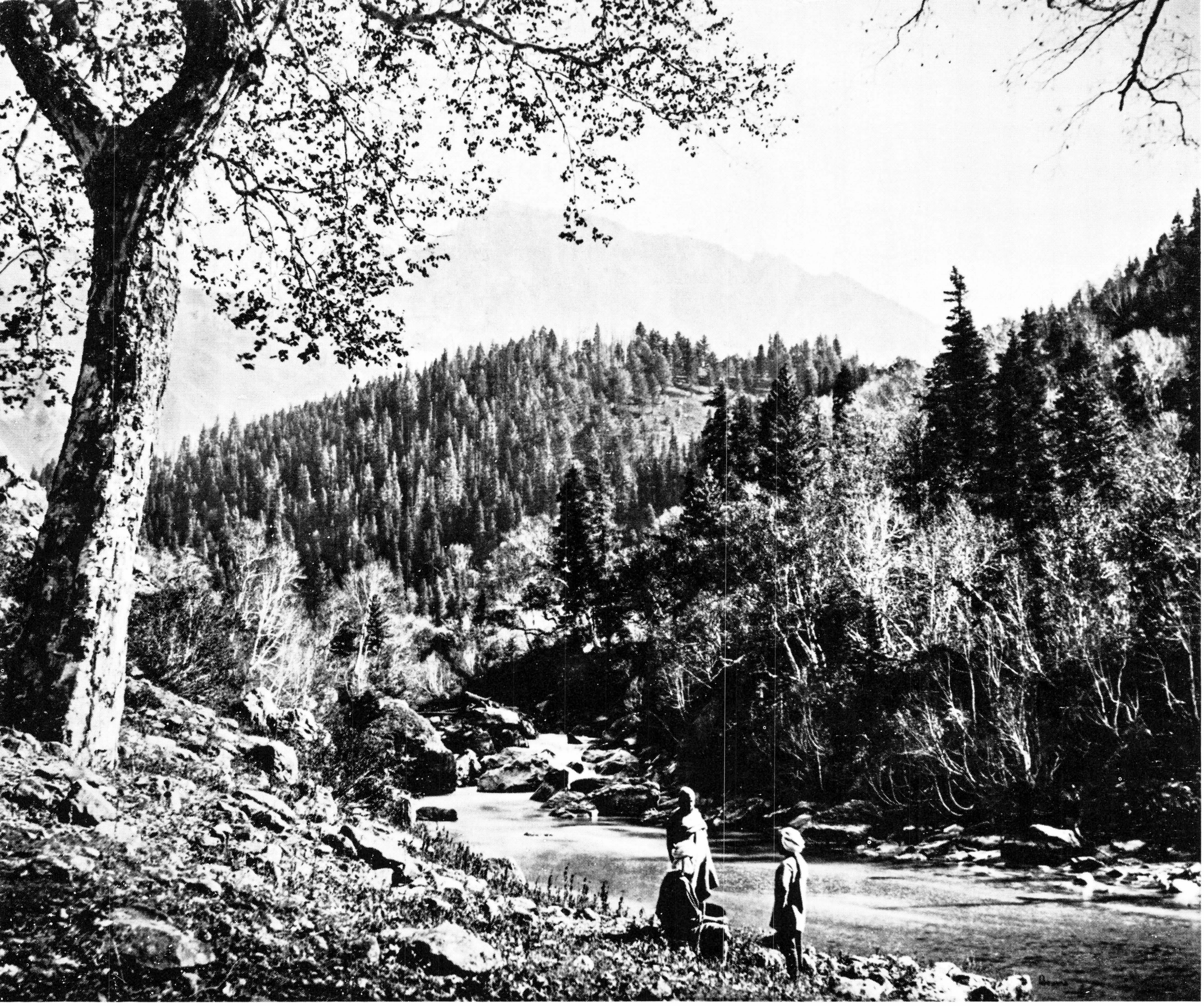


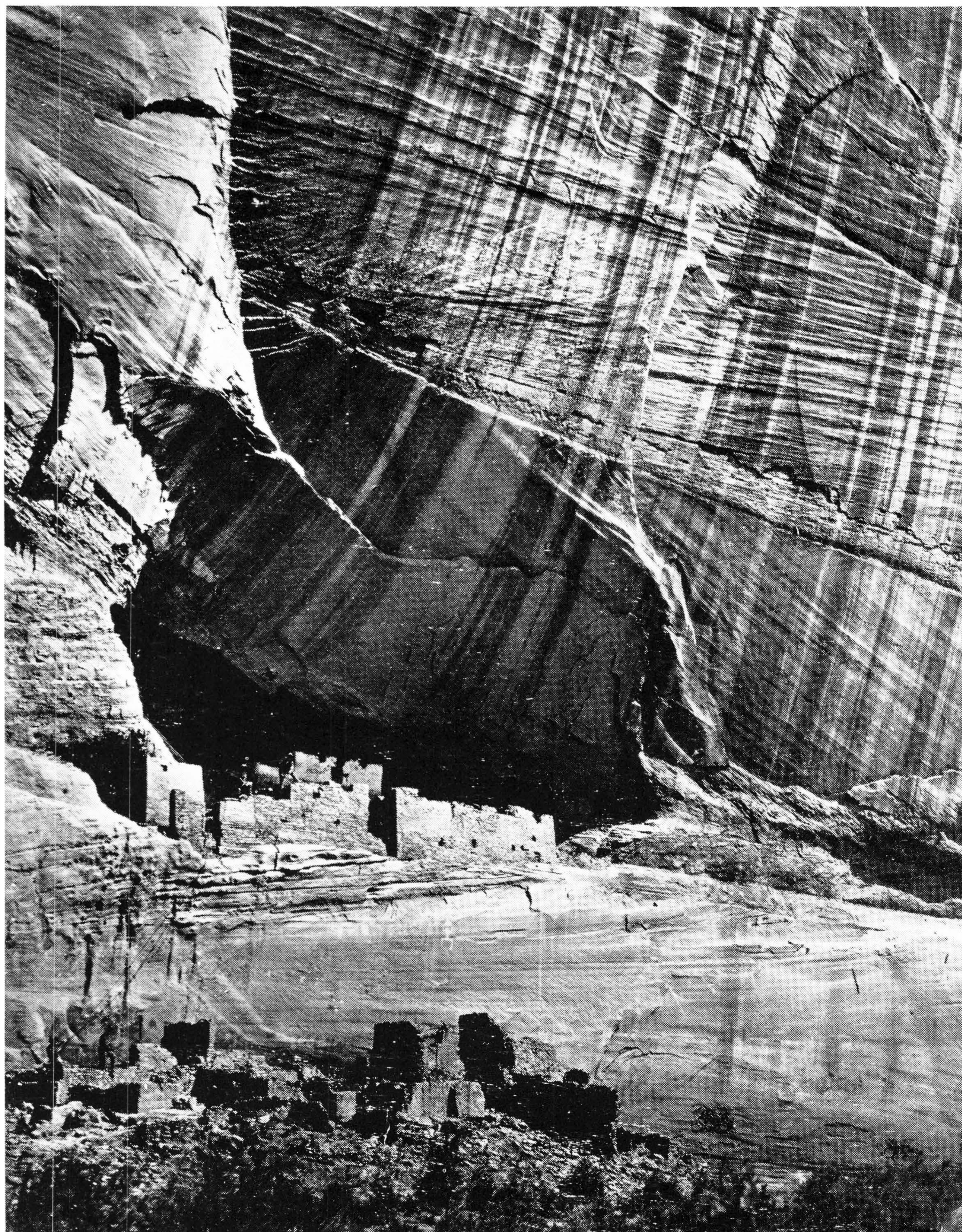
SECTION 2, HOLY LAND & SYRIA

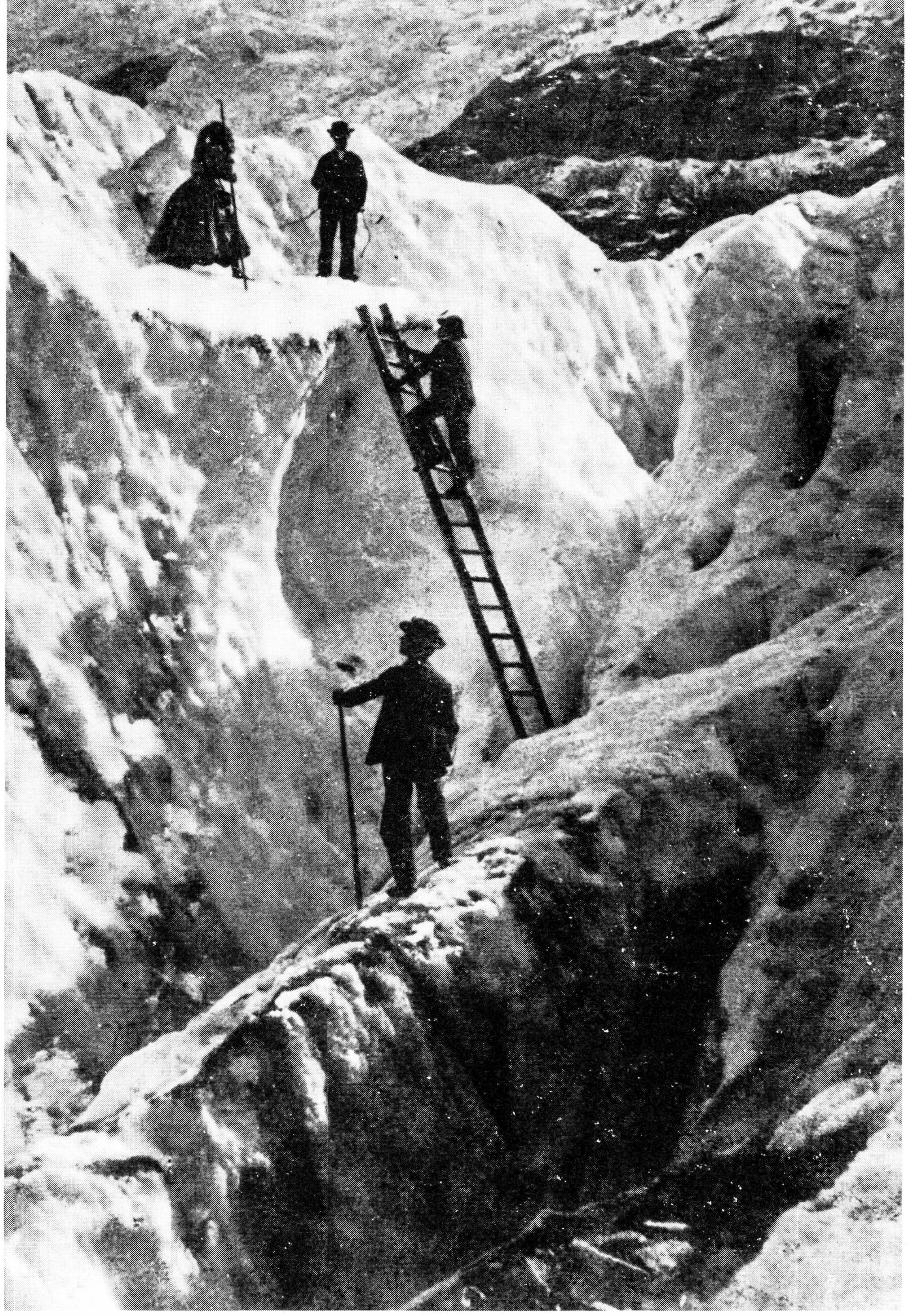
PHOTOGRAPHIC PICTURES
MADE BY Mr. FRANCIS BEDFORD DURING THE
TOUR IN THE EAST
IN WHICH BY COMMAND HE ACCOMPANIED
HIS ROYAL HIGHNESS THE PRINCE OF WALES

LONDON PUBLISHED BY DAY & SON
6, GATE STREET,
LITHOGRAPHERS TO THE QUEEN
LINCOLNS INN FIELDS.









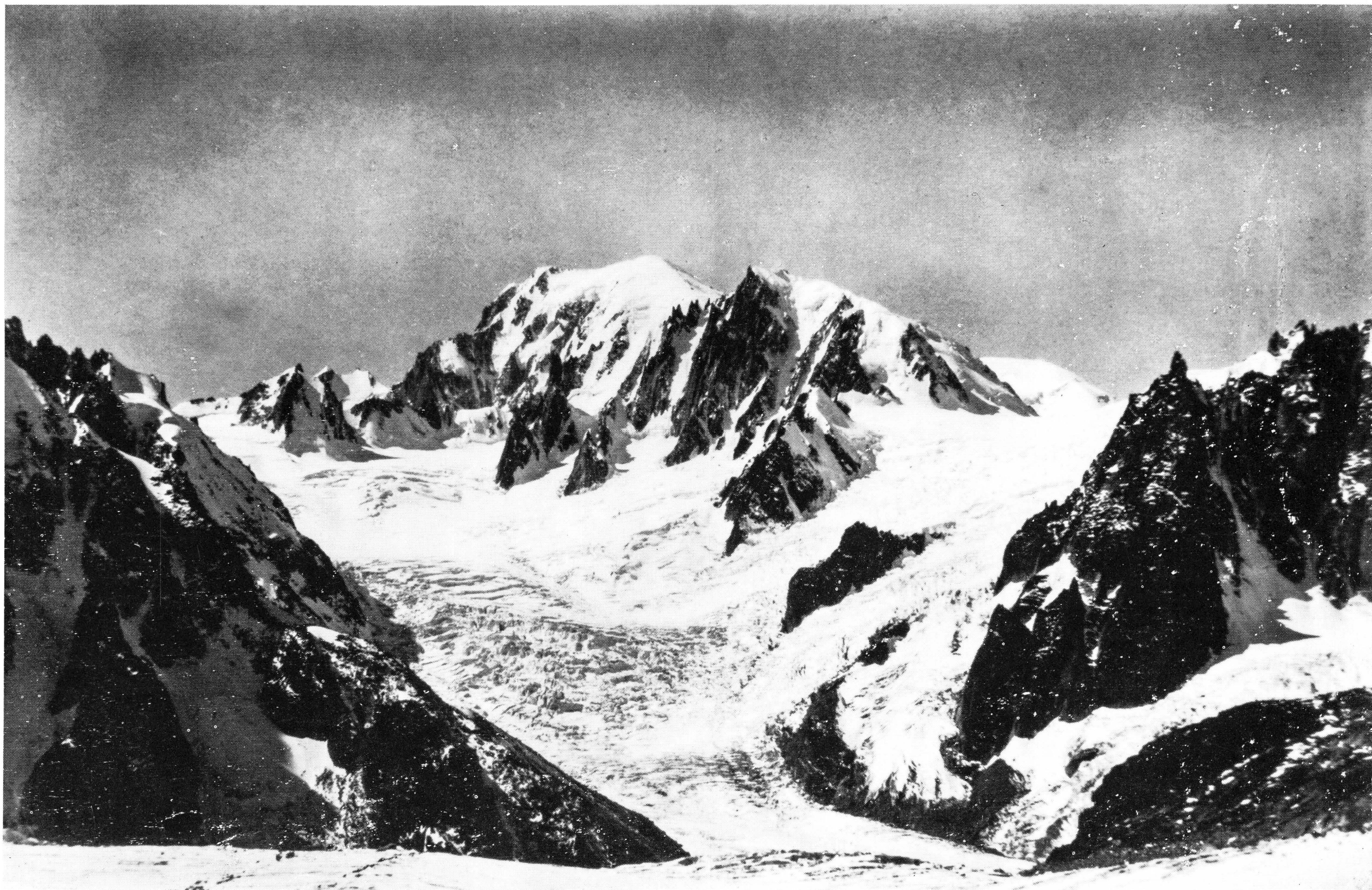
170 SAMUEL BOURNE. The Scinde River, 1864

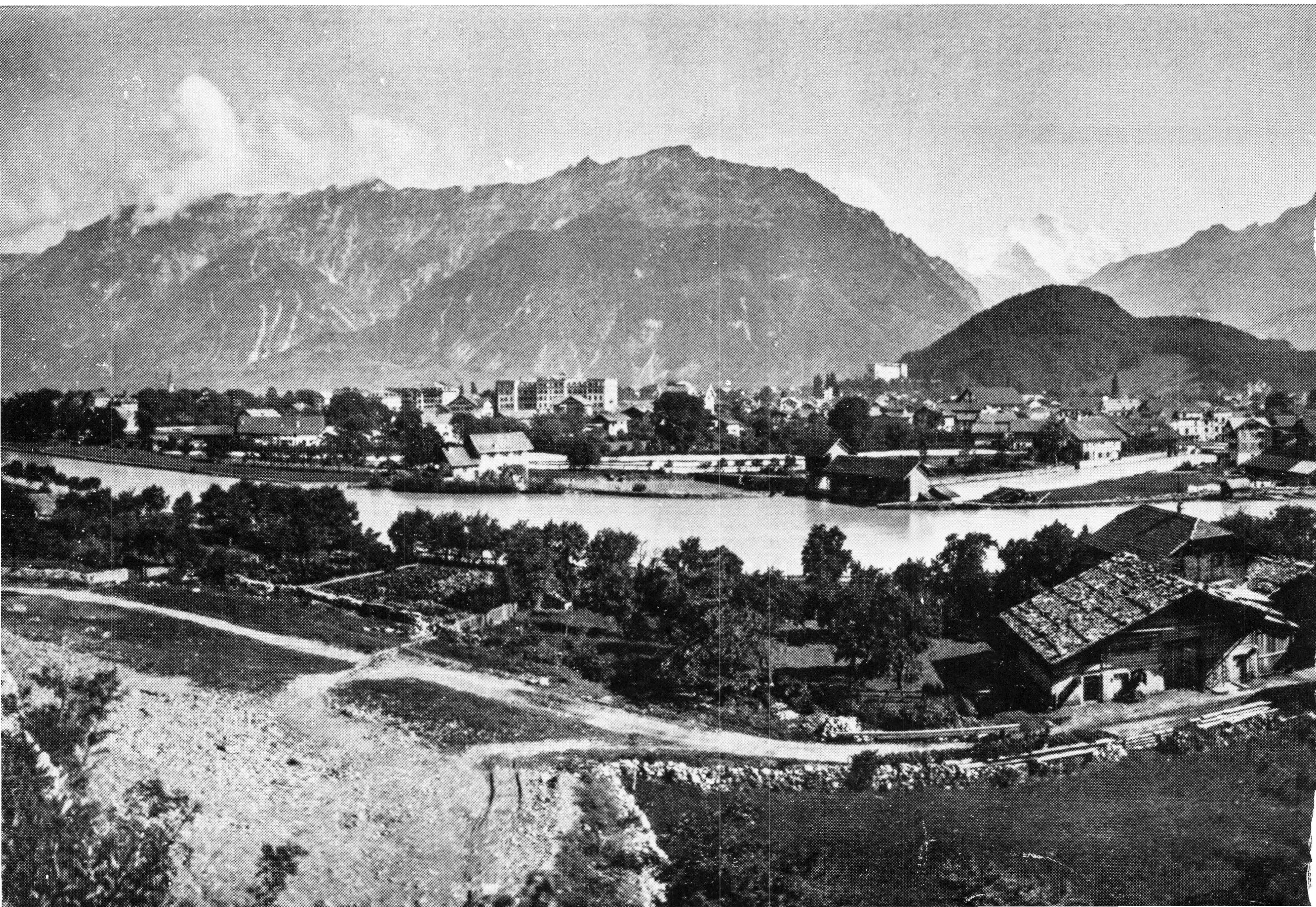
171 CARLETON E. WATKINS. Washington Column, Yosemite Valley, 1867

172 T. H. O'SULLIVAN. Canyon de Chelly, Arizona, 1873

173 ADOLPHE BRAUN. The Grindelwald glacier. Carte-de-visite, *c.* 1862

174 AUGUSTE BISSON. Mont Blanc and the Mer de Glace, 1861



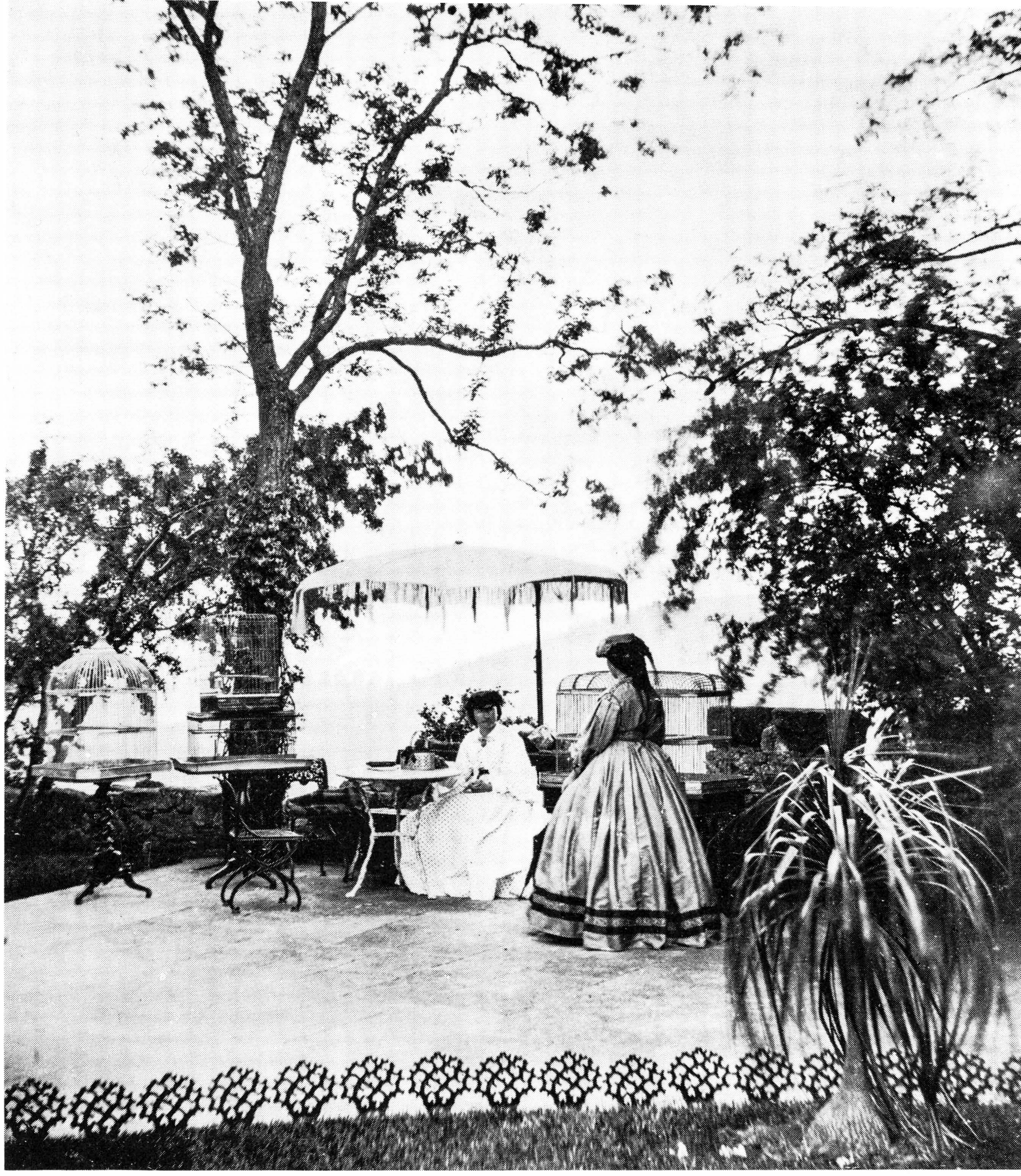


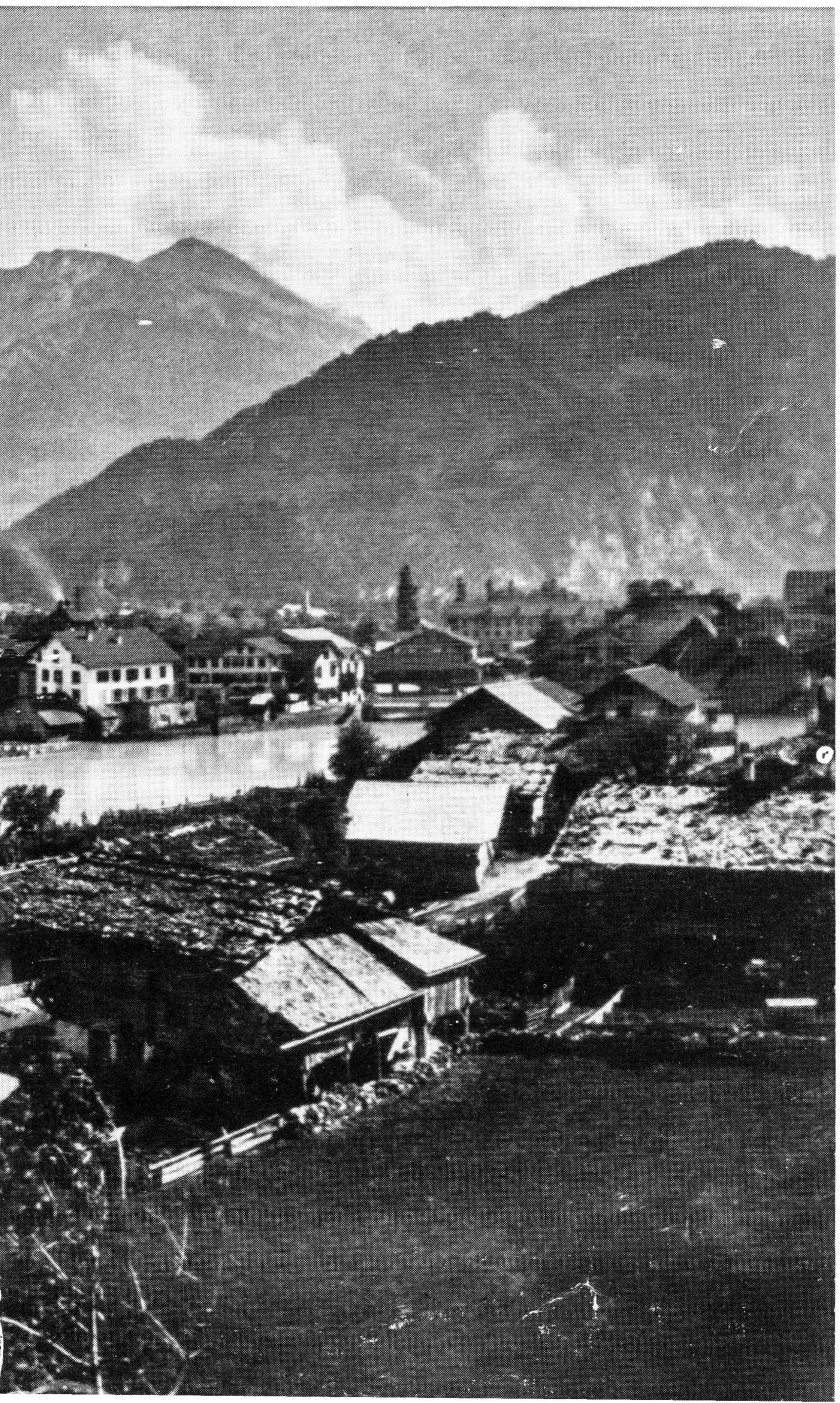
175 WILLIAM ENGLAND. Lake Orta, *c.* 1864

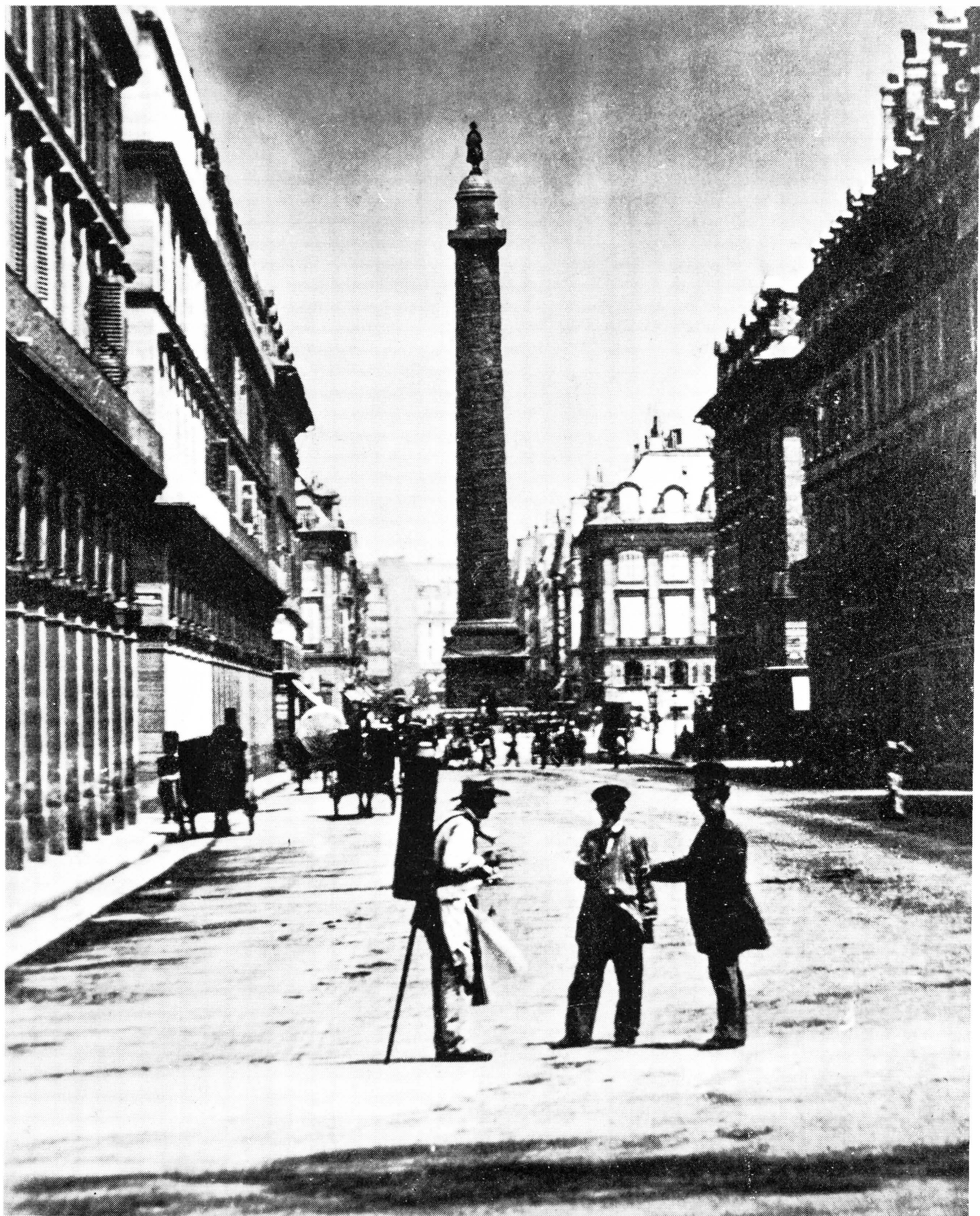
176 ADOLPHE BRAUN. Panoramic view of Interlaken taken with Johnson's Pantoscopic camera. Carbon print, *c.* 1868

177 ADOLPHE BRAUN. Garden scene, probably on an Italian lake, *c.* 1860

178 ADOLPHE BRAUN. Rue Castiglione and the Vendôme Column, Paris, *c.* 1858



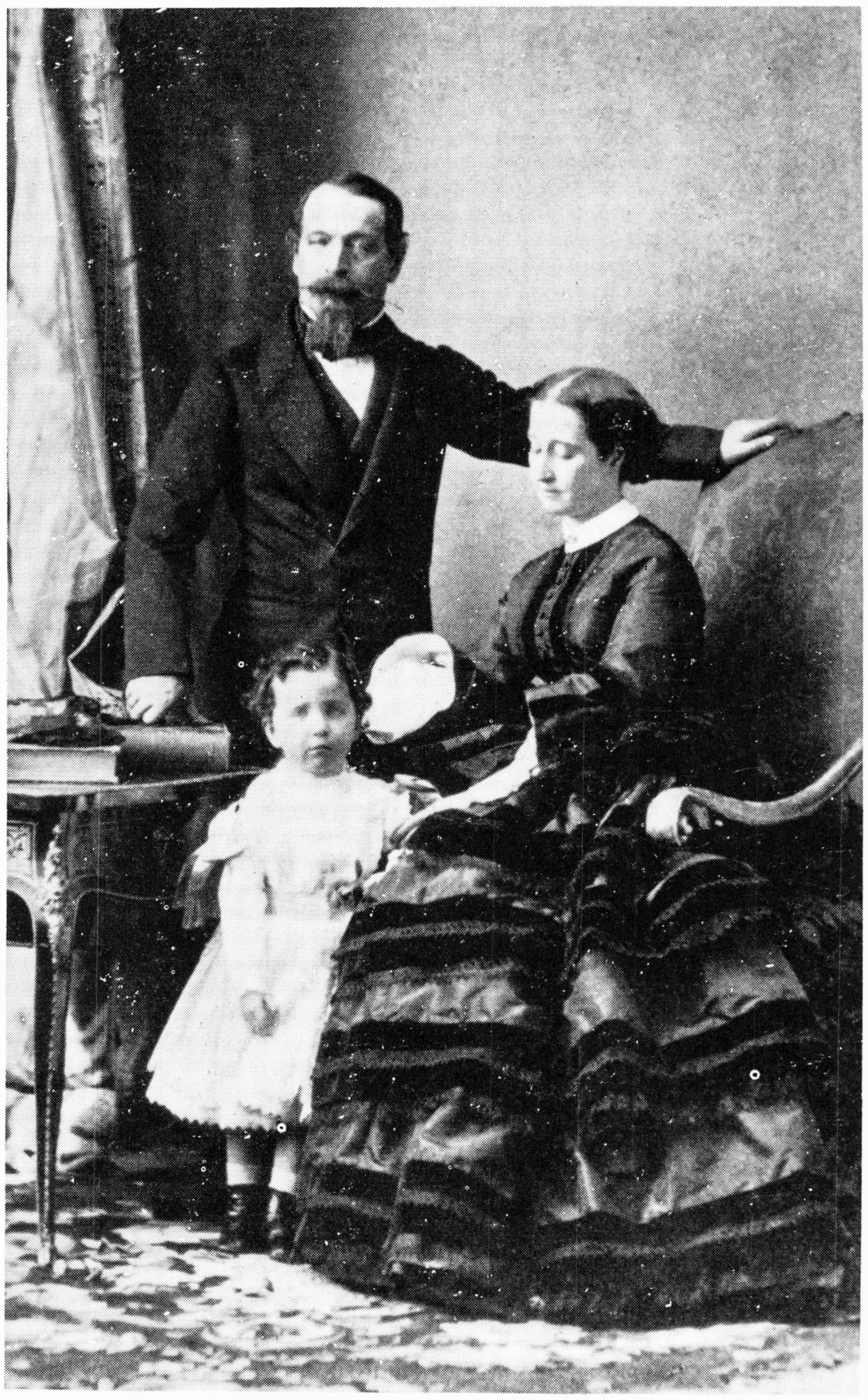


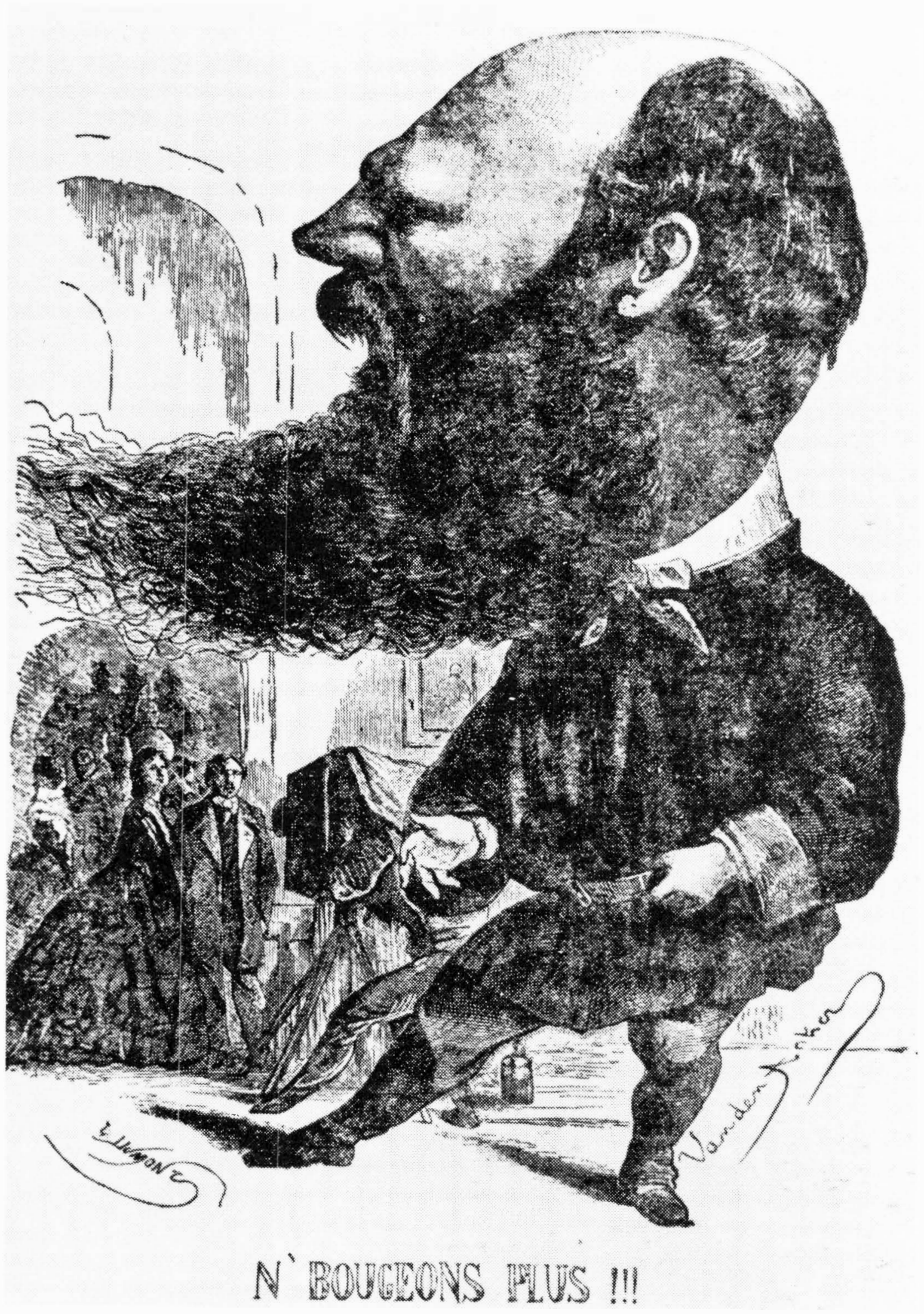


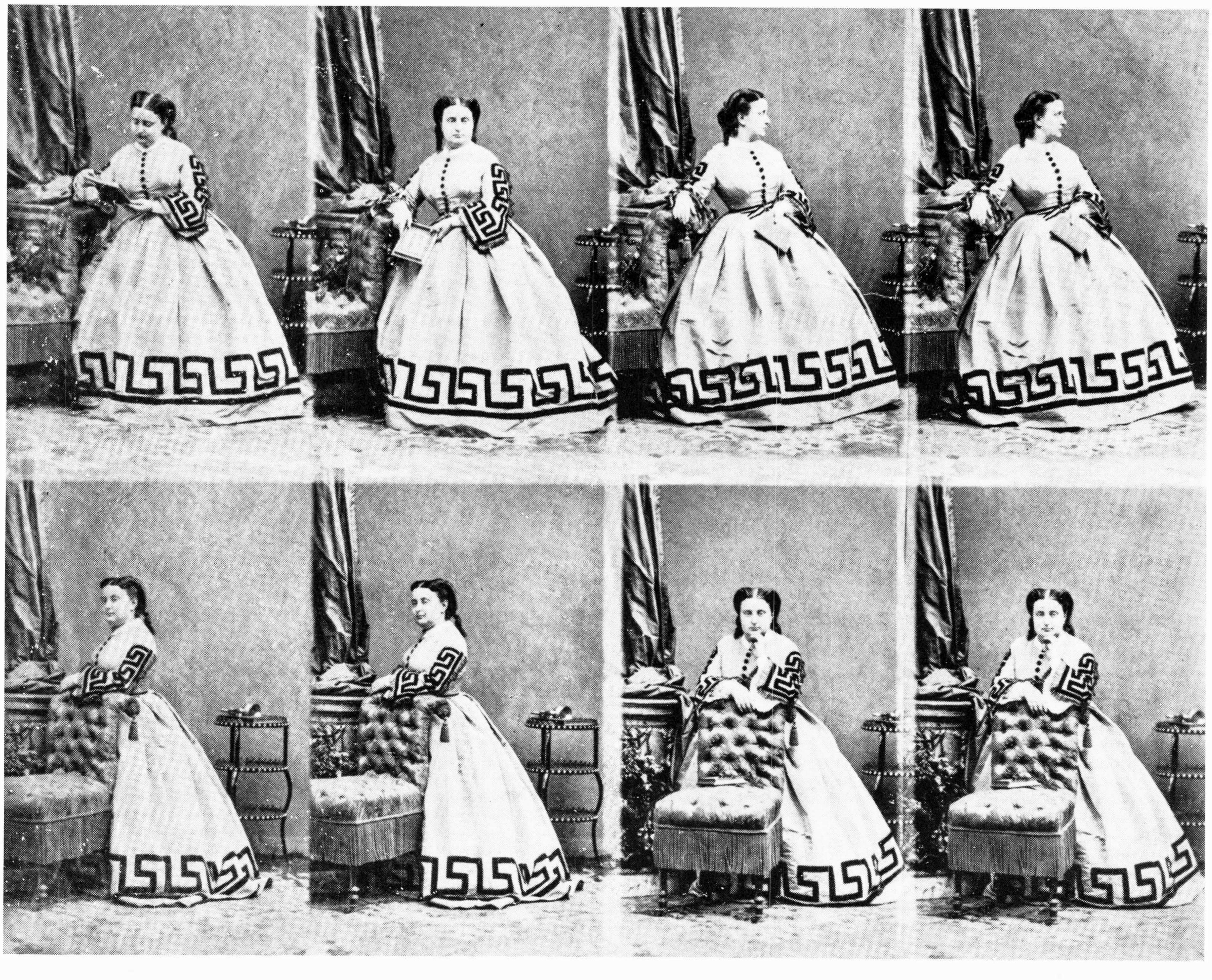
179 DISDÉRI. The French Imperial family. Carte-de-visite, 1859

180 Caricature of DISDÉRI by Van den Acker, 1861

181 DISDÉRI. Uncut sheet of carte-de-visite portraits of Princess Gabrielle Buonaparte, *c.* 1862



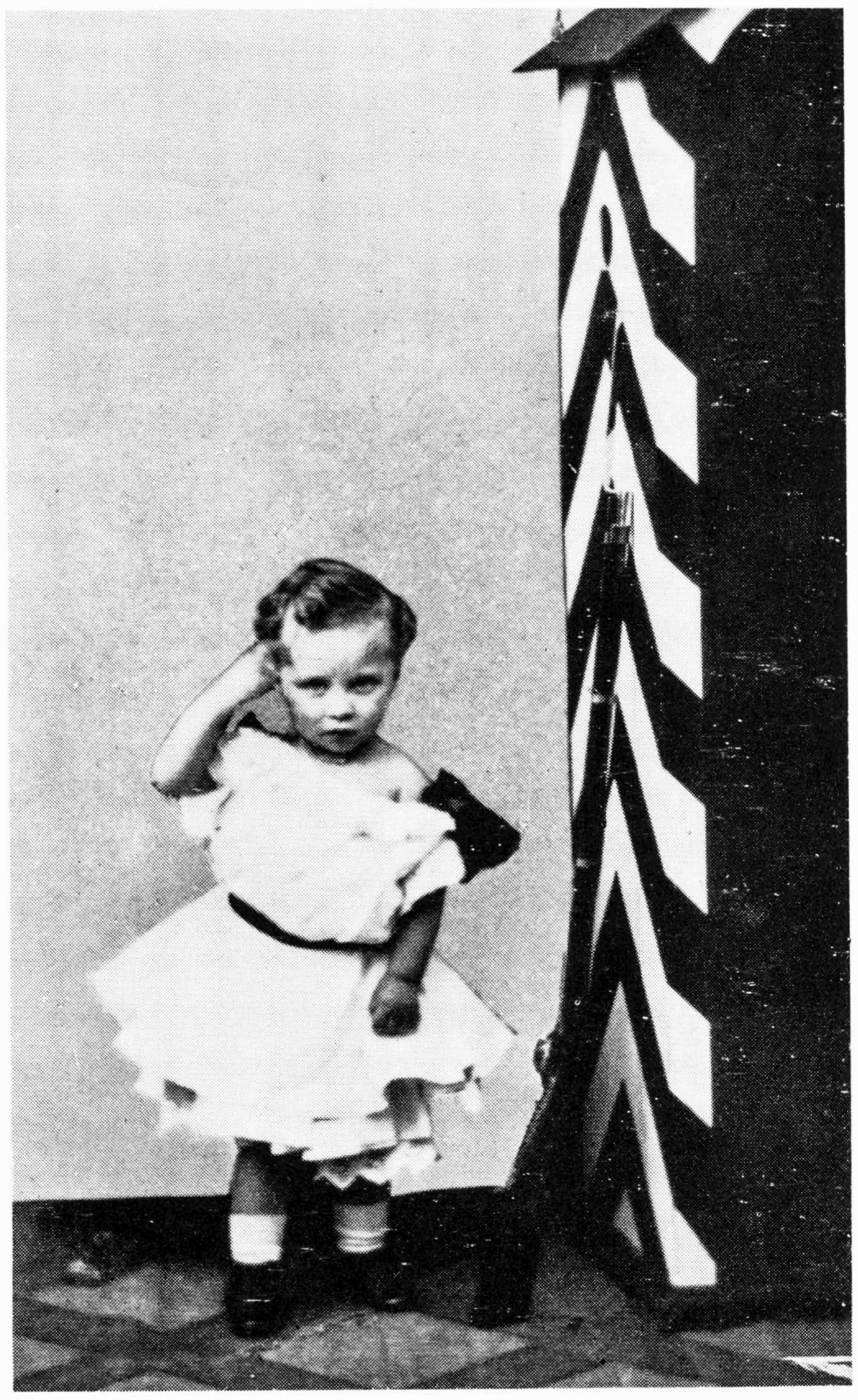

Vanden Acker
N' BOUGEONS PLUS !!!

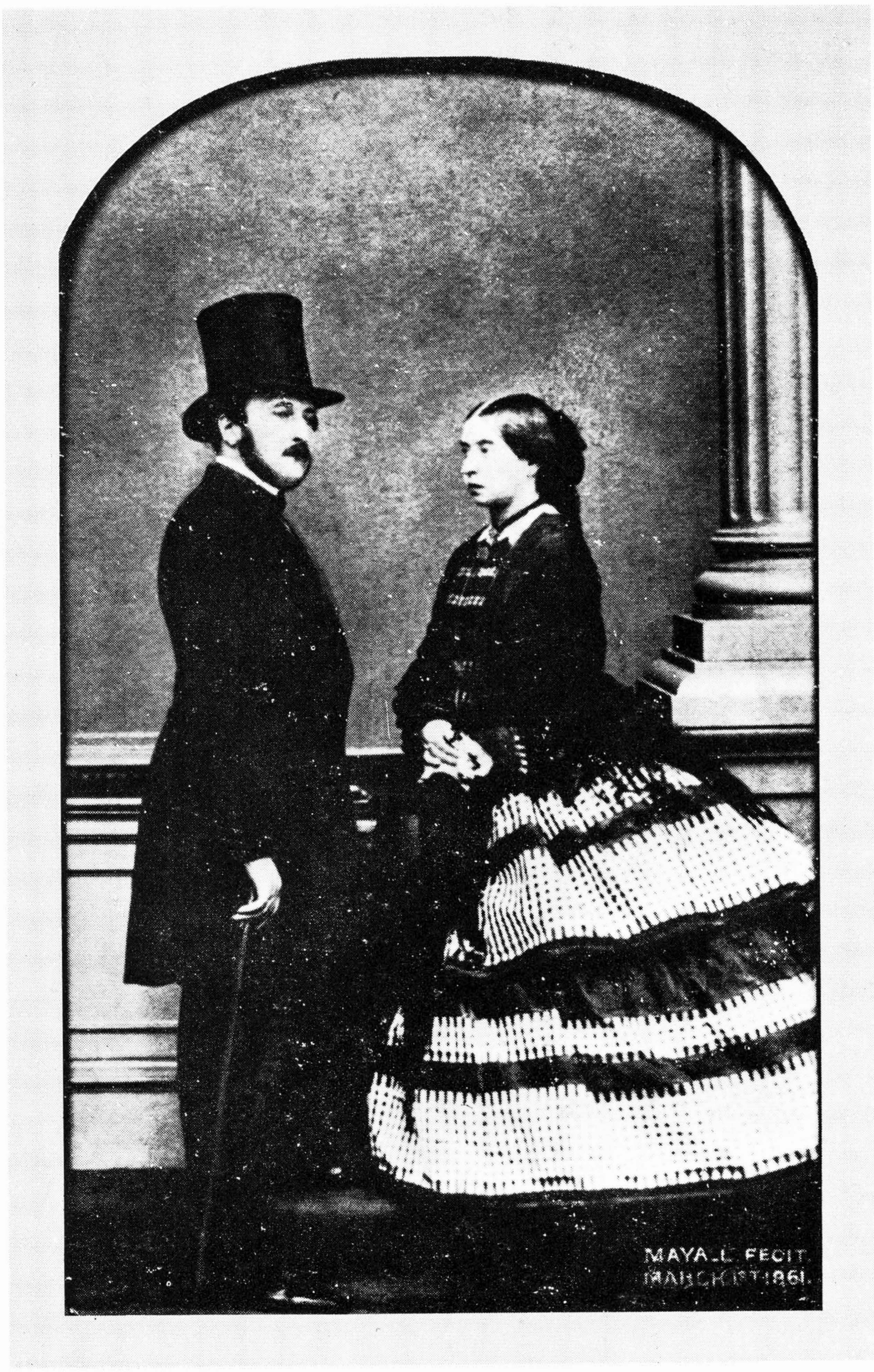


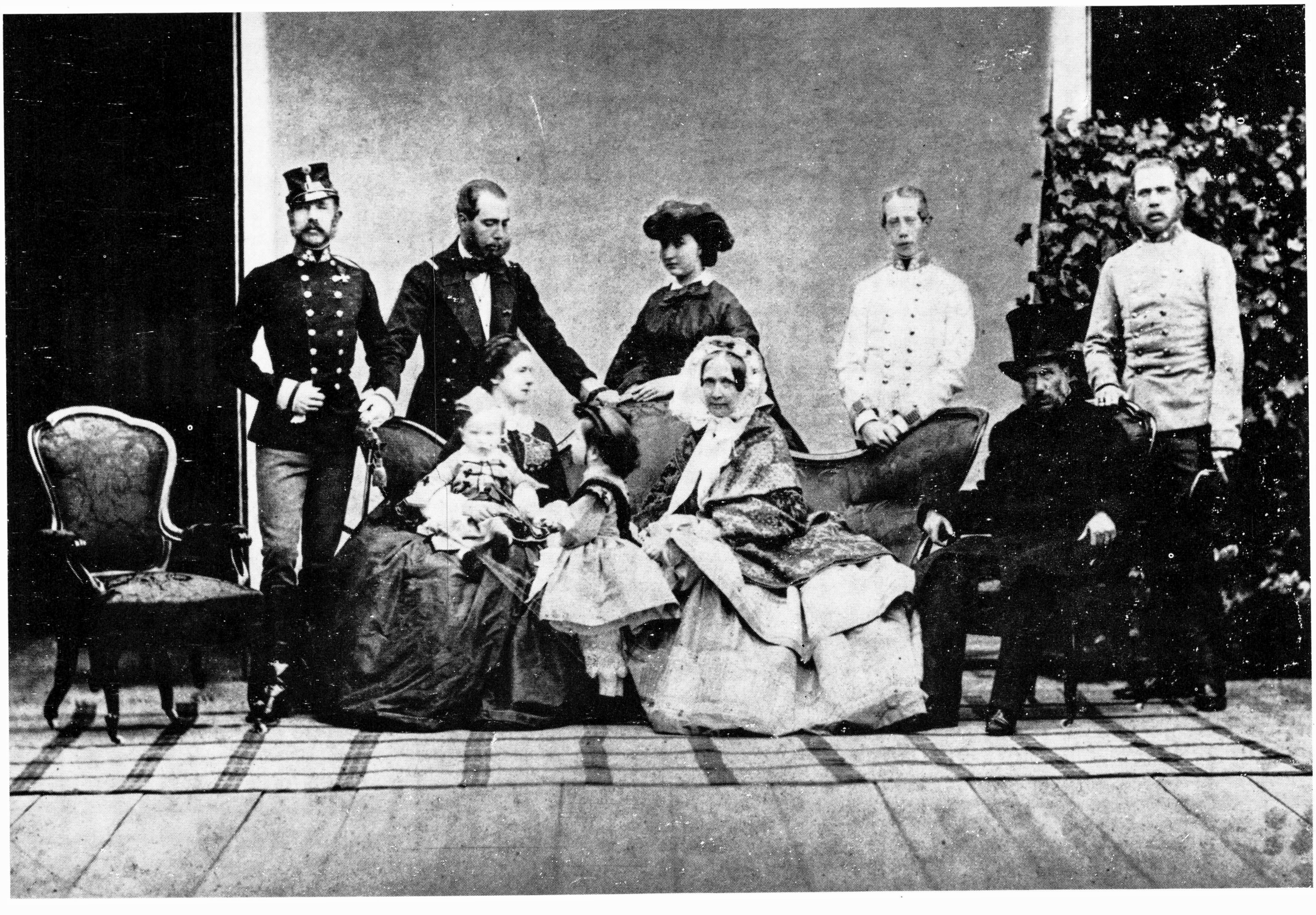
182 L. HAASE. 'Little Willy's first salute' (the future Kaiser Wilhelm II). Carte-de-visite, December 1860

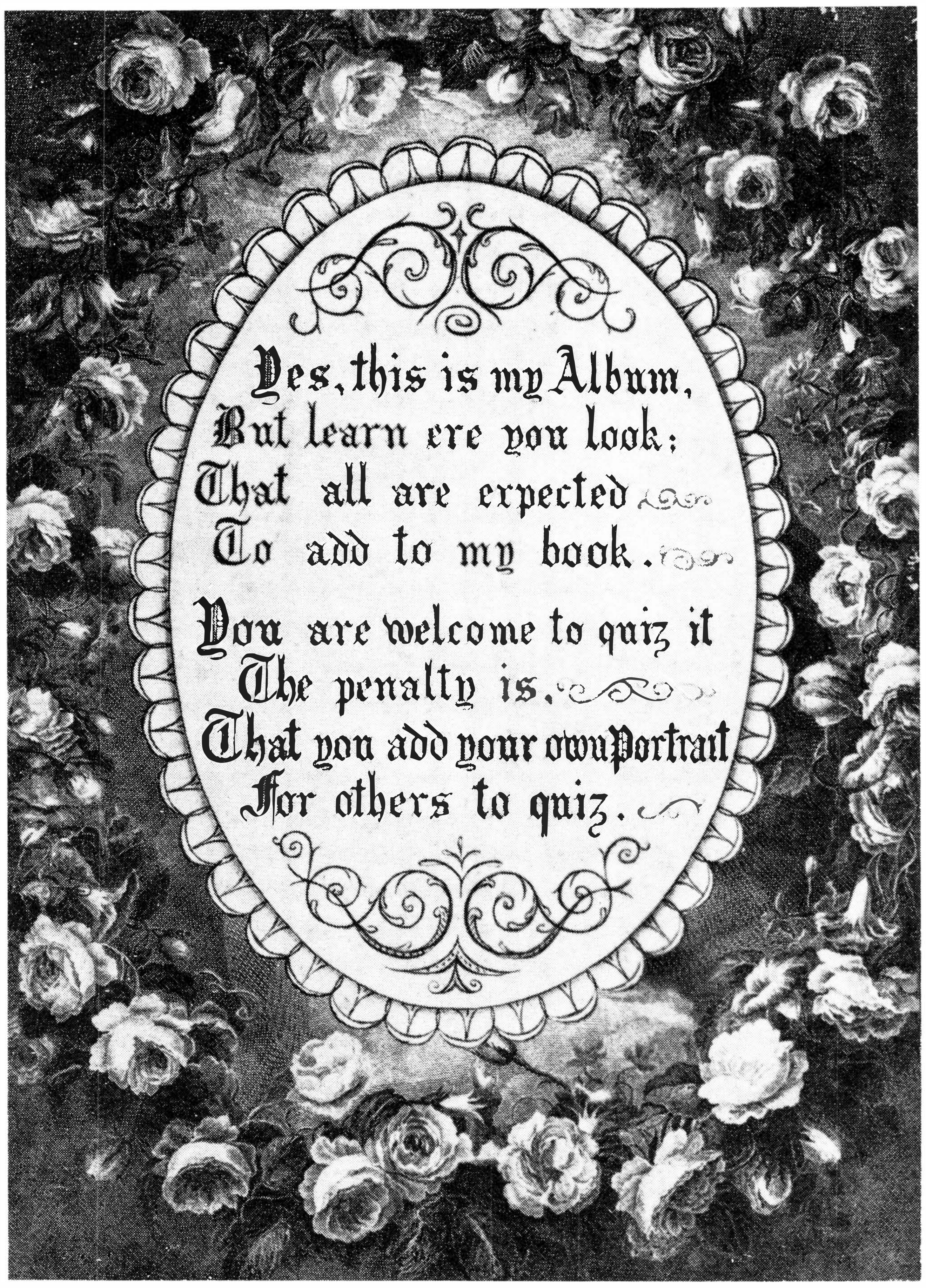
183 J. E. MAYALL. Queen Victoria and Prince Albert. Carte-de-visite, March 1861

184 LUDWIG ANGERER. The Austrian Imperial family. Silver print, 7 in. × 9½ in., 1859




MAYALL FECIT
MARCH 1ST 1861





Yes, this is my Album,
But learn ere you look:
That all are expected
To add to my book.

You are welcome to quiz it
The penalty is,
That you add your own Portrait
For others to quiz.

185 Album *carte* inviting further contributions

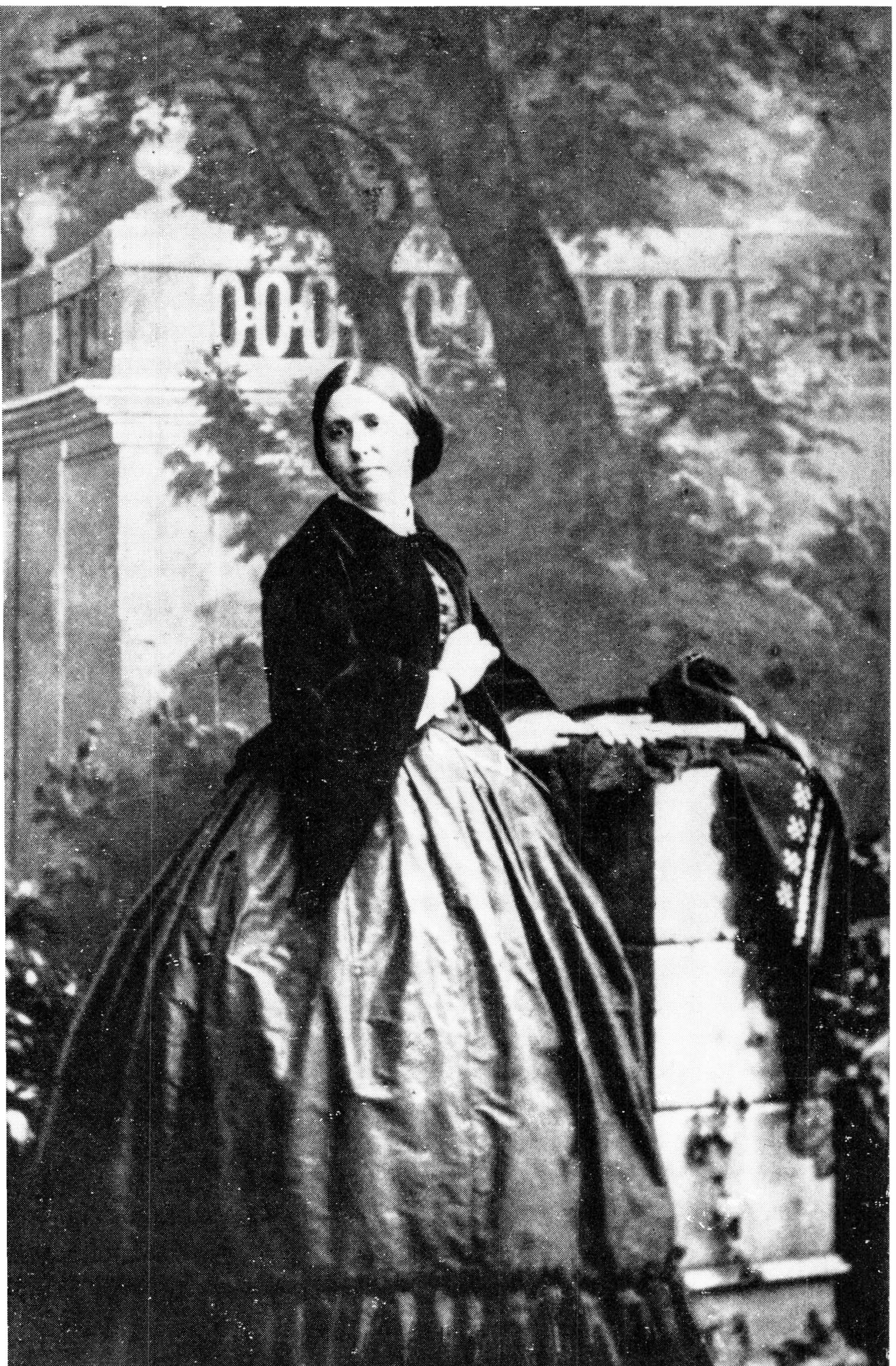
186 CAMILLE DE SILVY. Unknown lady. Carte-de-visite, *c.* 1862

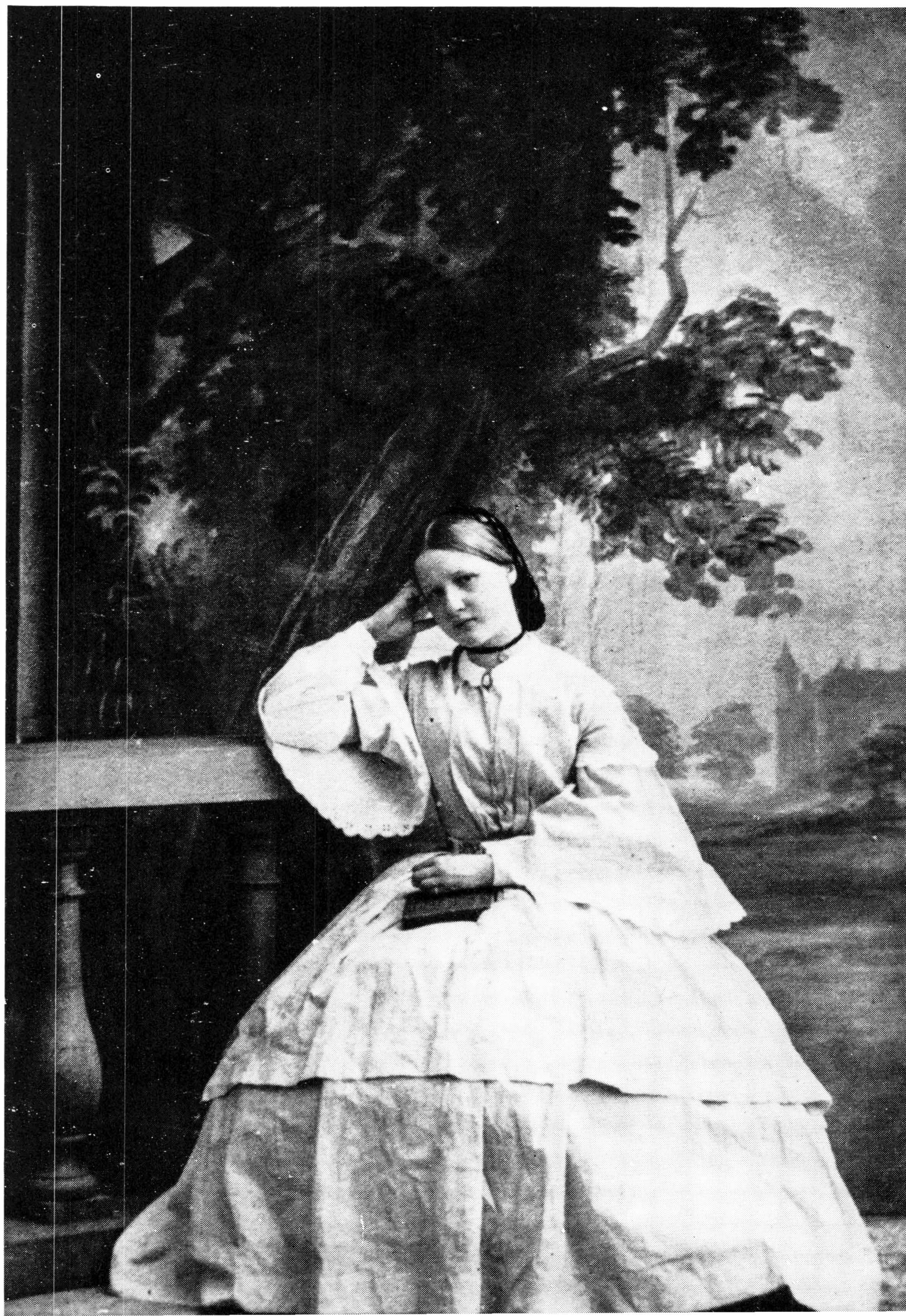
187 CAMILLE DE SILVY. Miss Susie Forster. Carte-de-visite, *c.* 1860

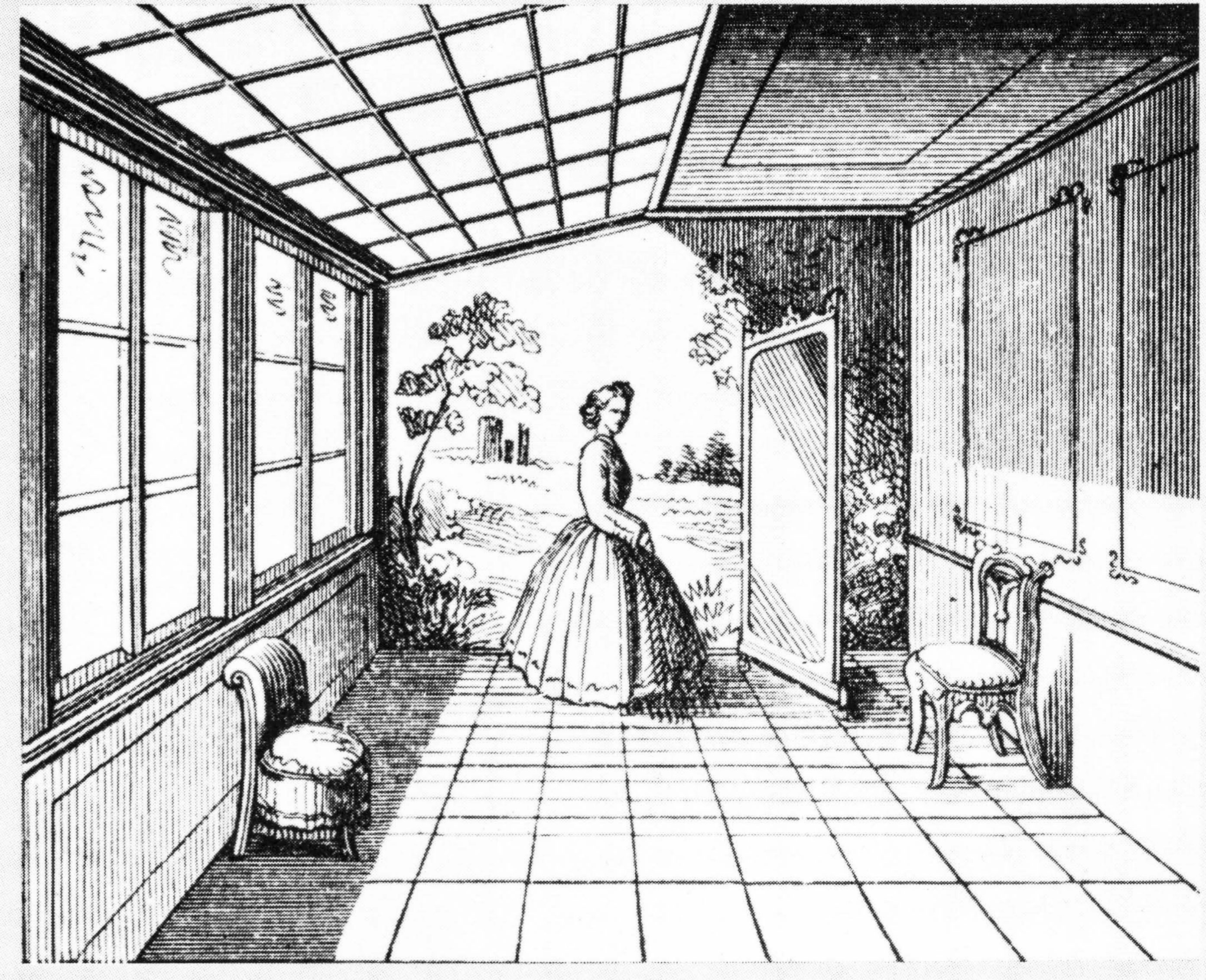
188, 189 Studios in the carte-de-visite period, *c.* 1865

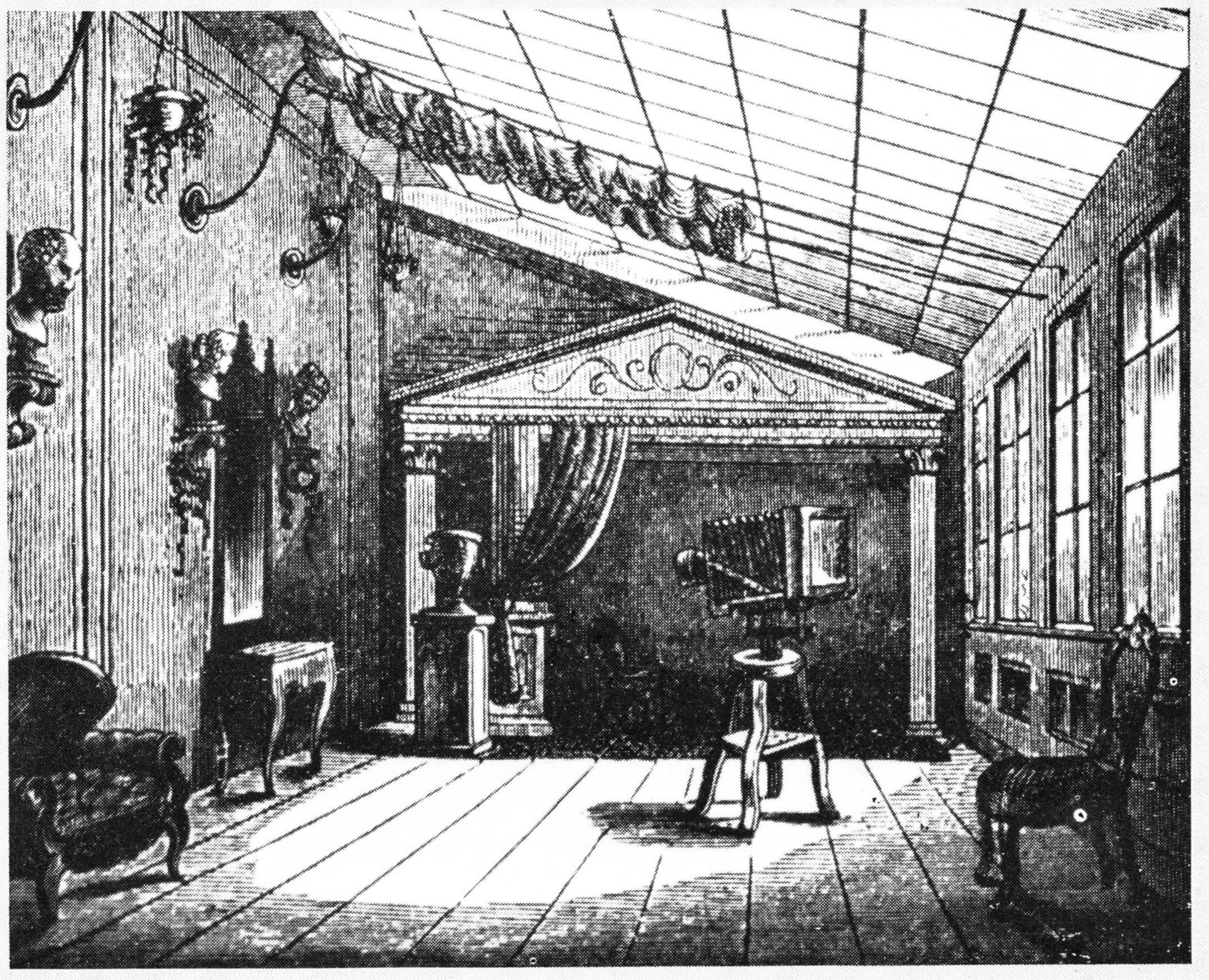
190 Carte-de-visite camera made by ALEXIS MILLET, Paris, taking four exposures on a $6\frac{1}{2}$ in. × $8\frac{1}{2}$ in. plate, *c.* 1862

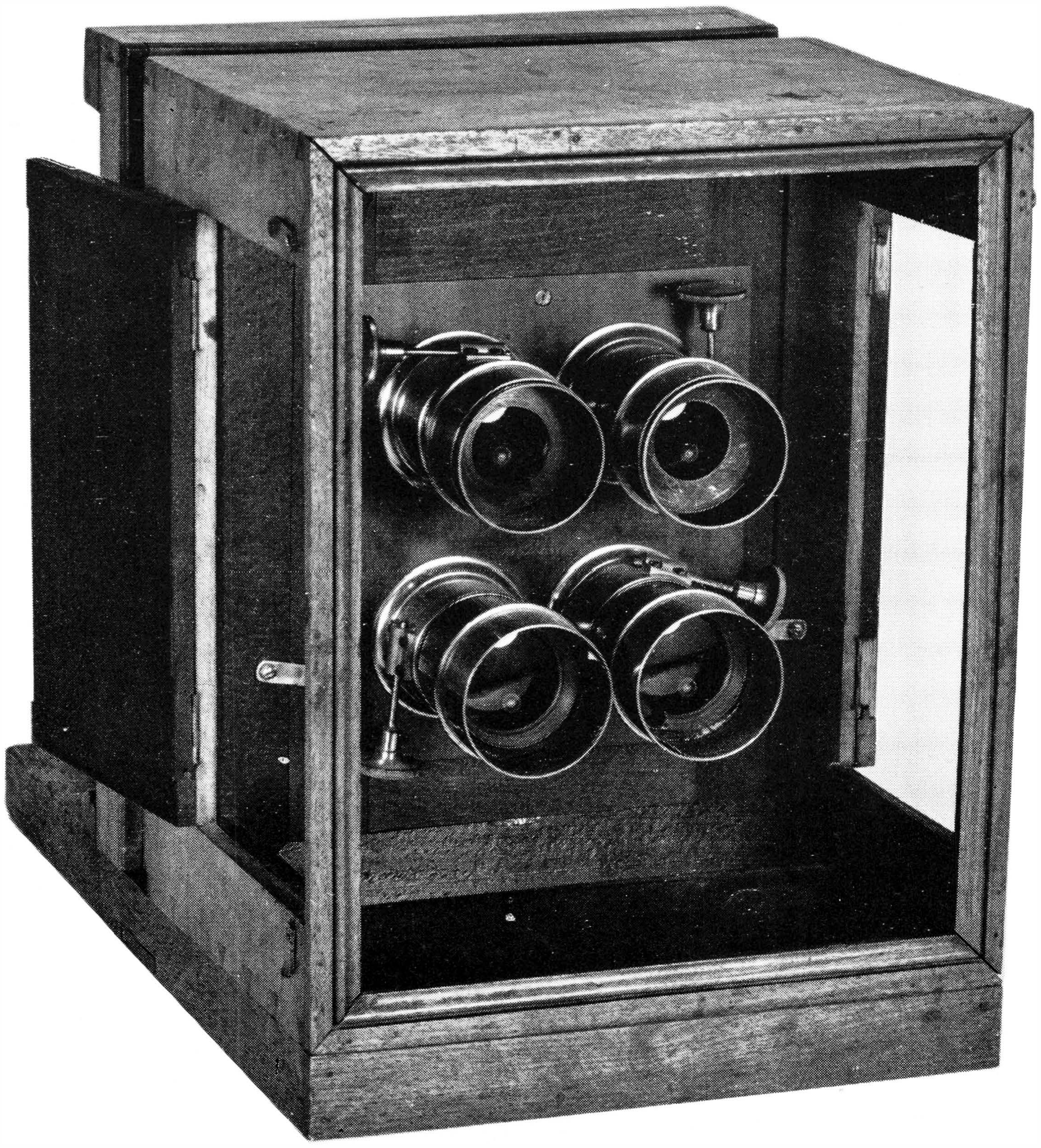
191 WILLIAM CARRICK. Multiple carte-de-visite, 1863

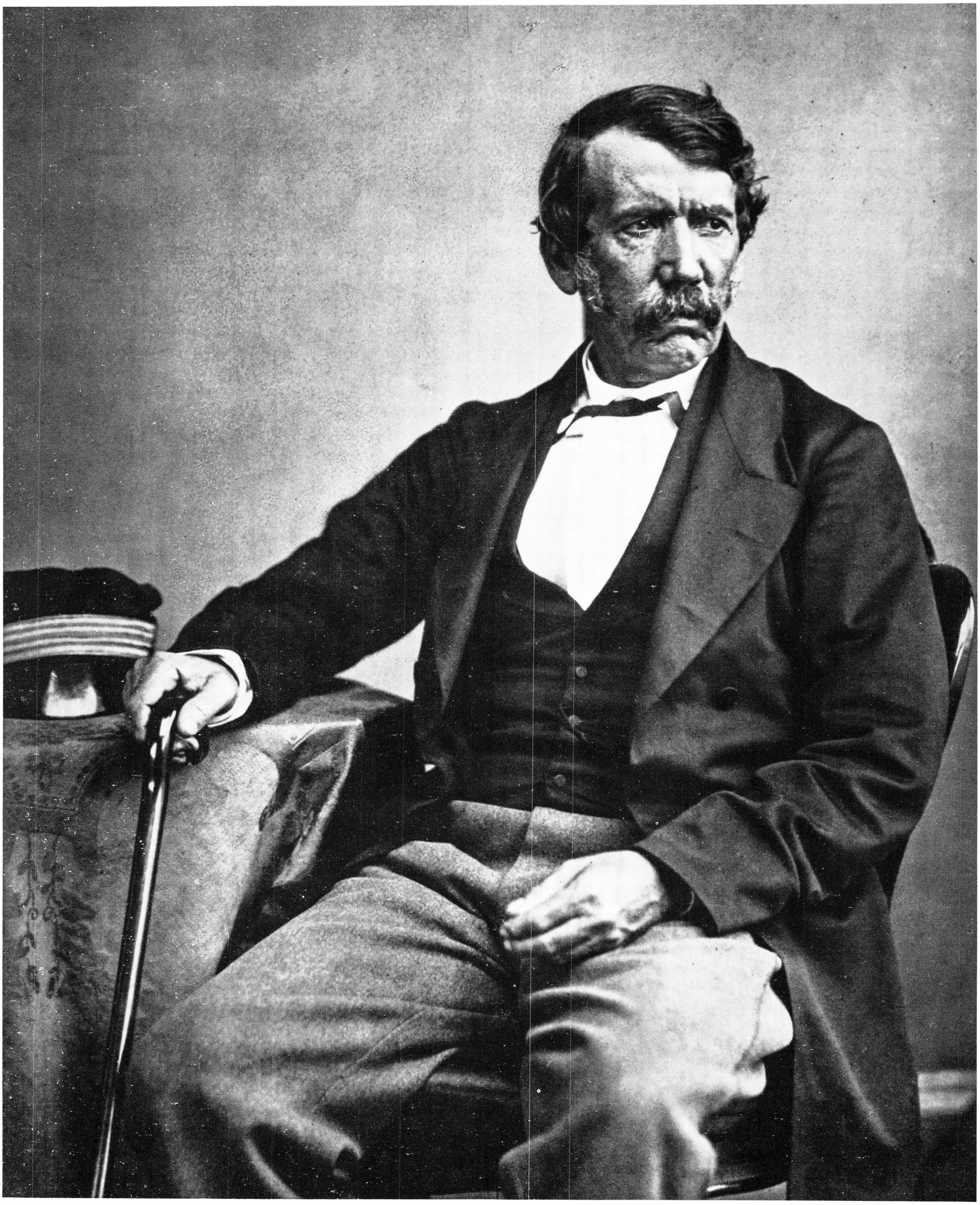










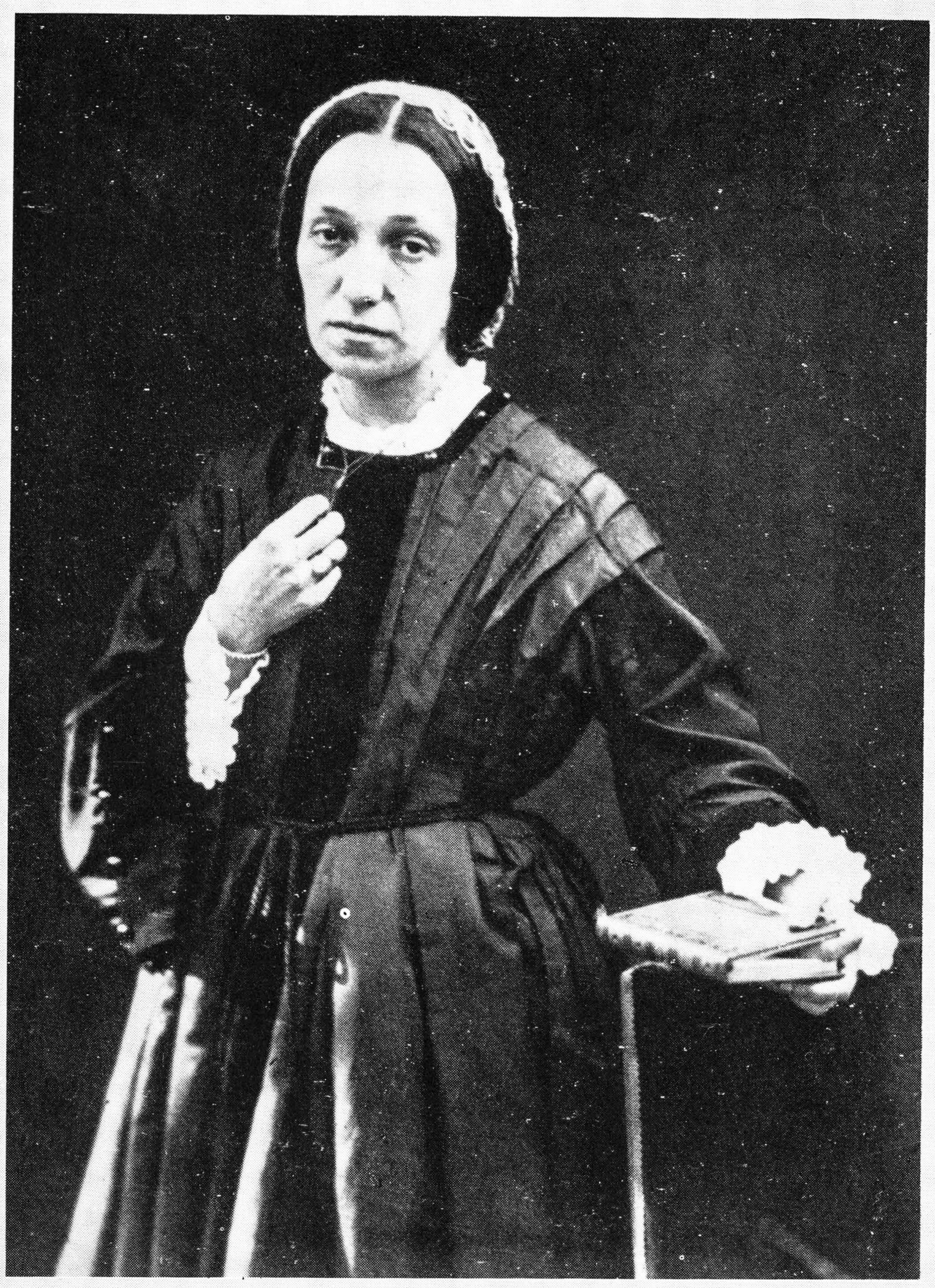


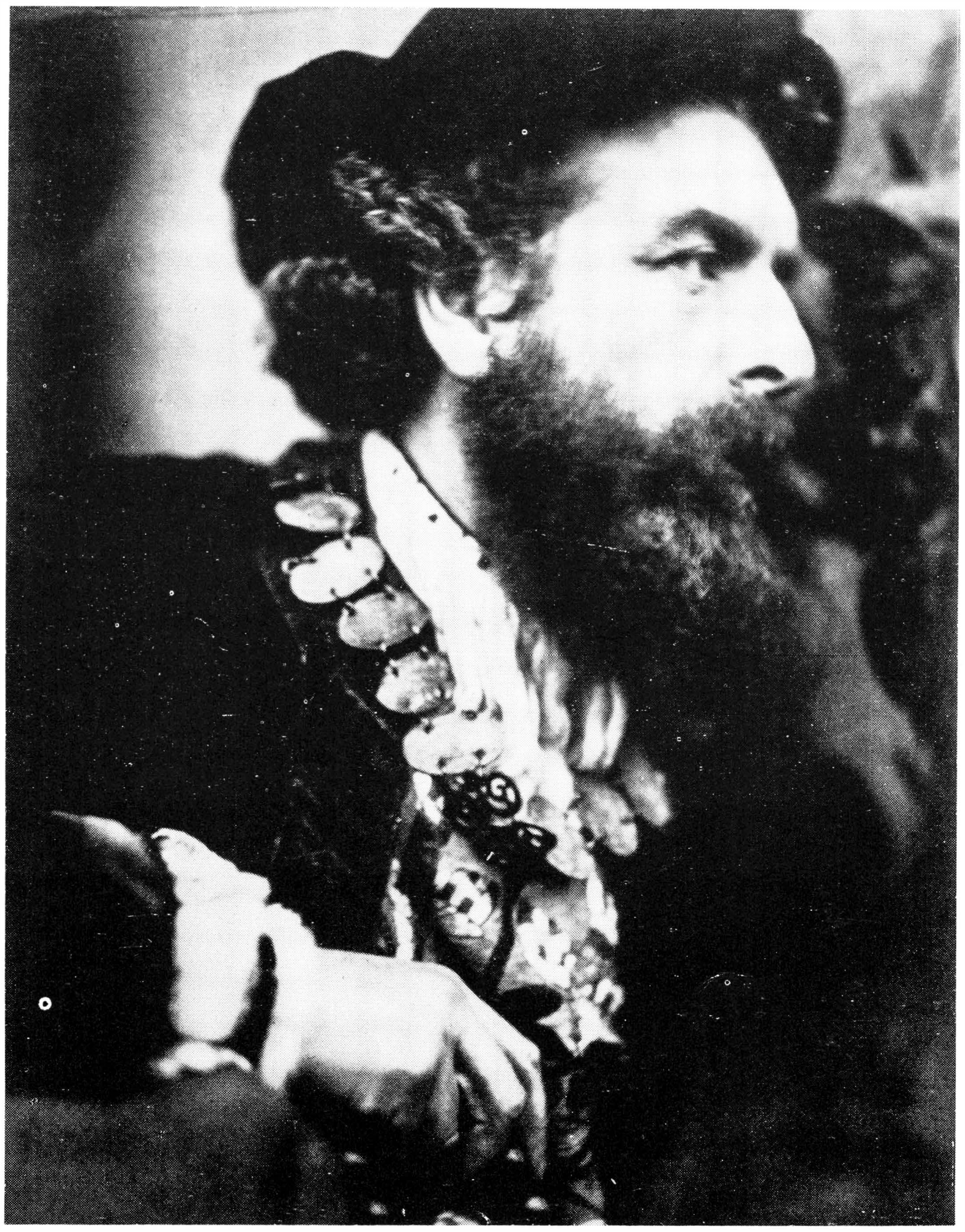
192 THOMAS ANNAN. David Livingstone, 1864

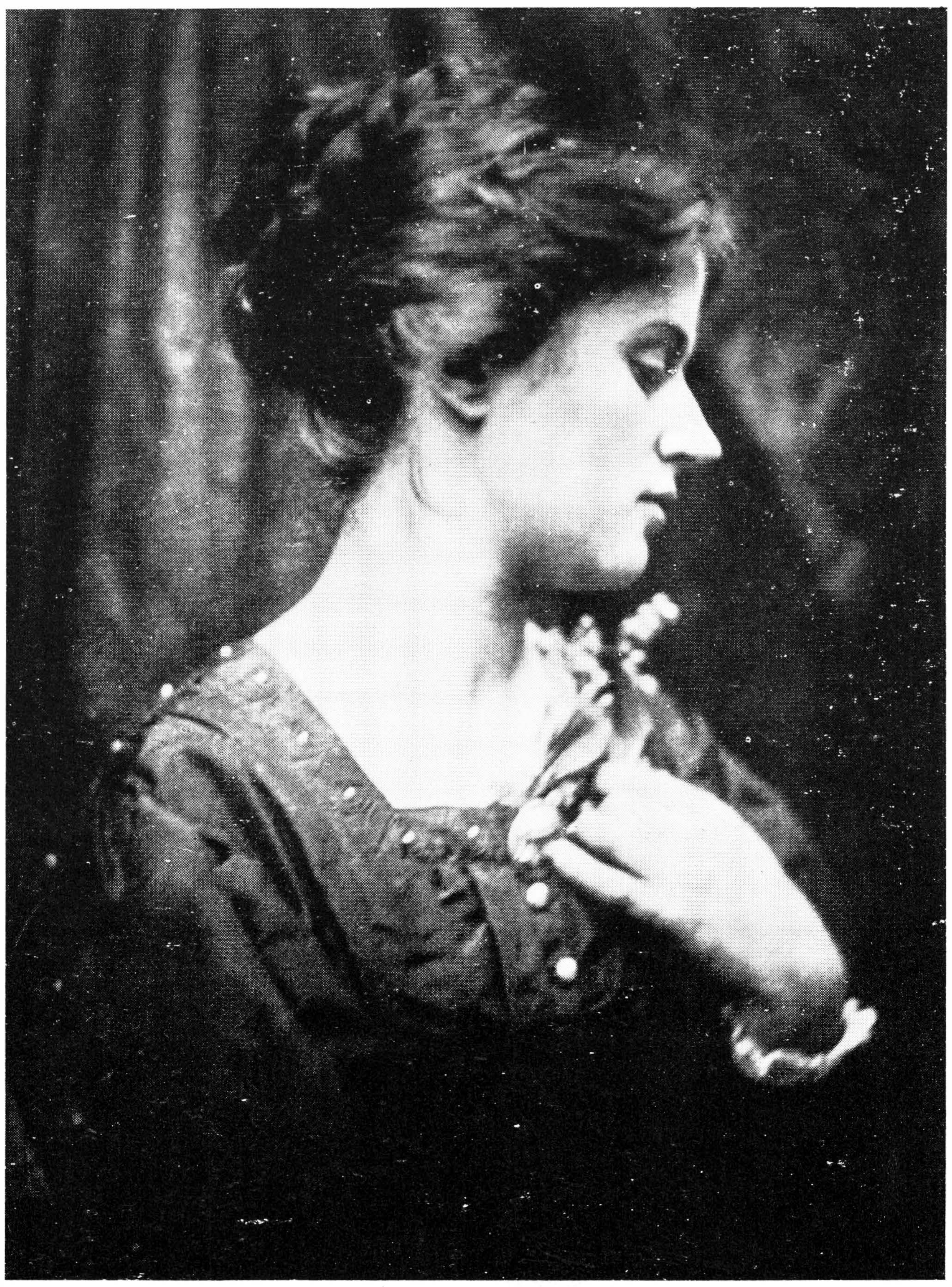
193 JULIA MARGARET CAMERON, photograph by her brother-in-law, Lord Somers, *c.* 1860

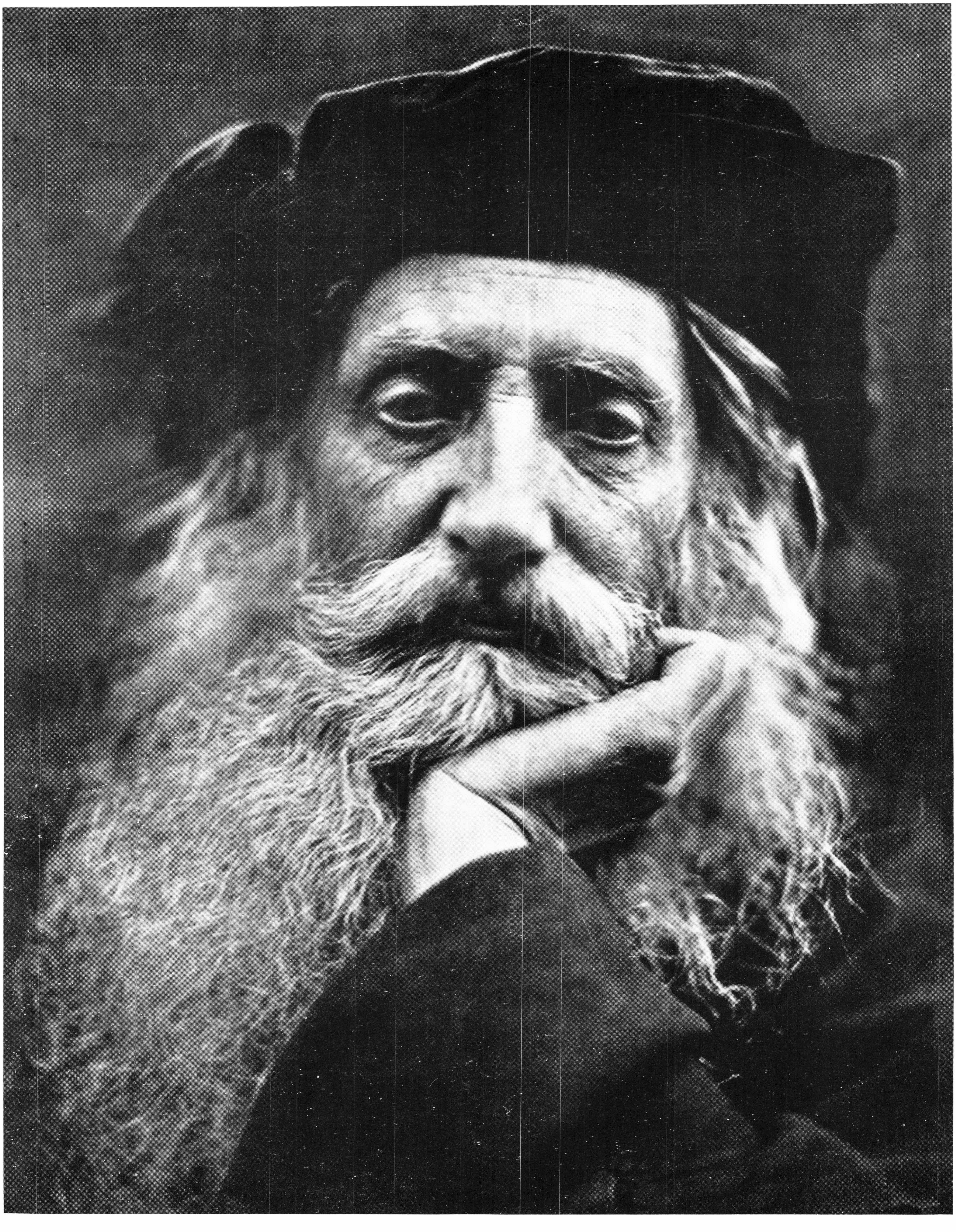
194 DAVID WILKIE WYNFIELD. Henry W. Philipps, 1863

195 JULIA MARGARET CAMERON. Marie Spartali, *c.* 1868







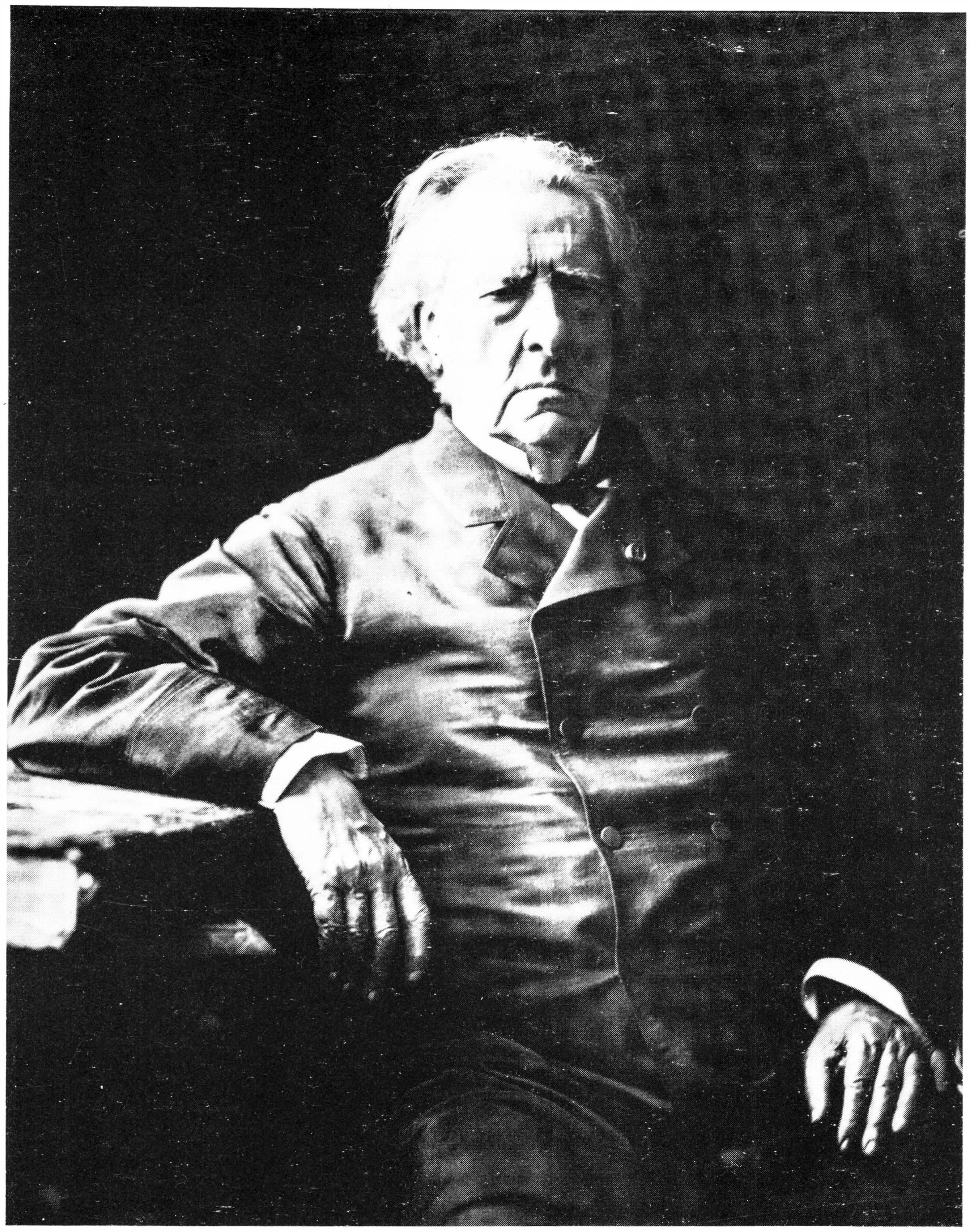


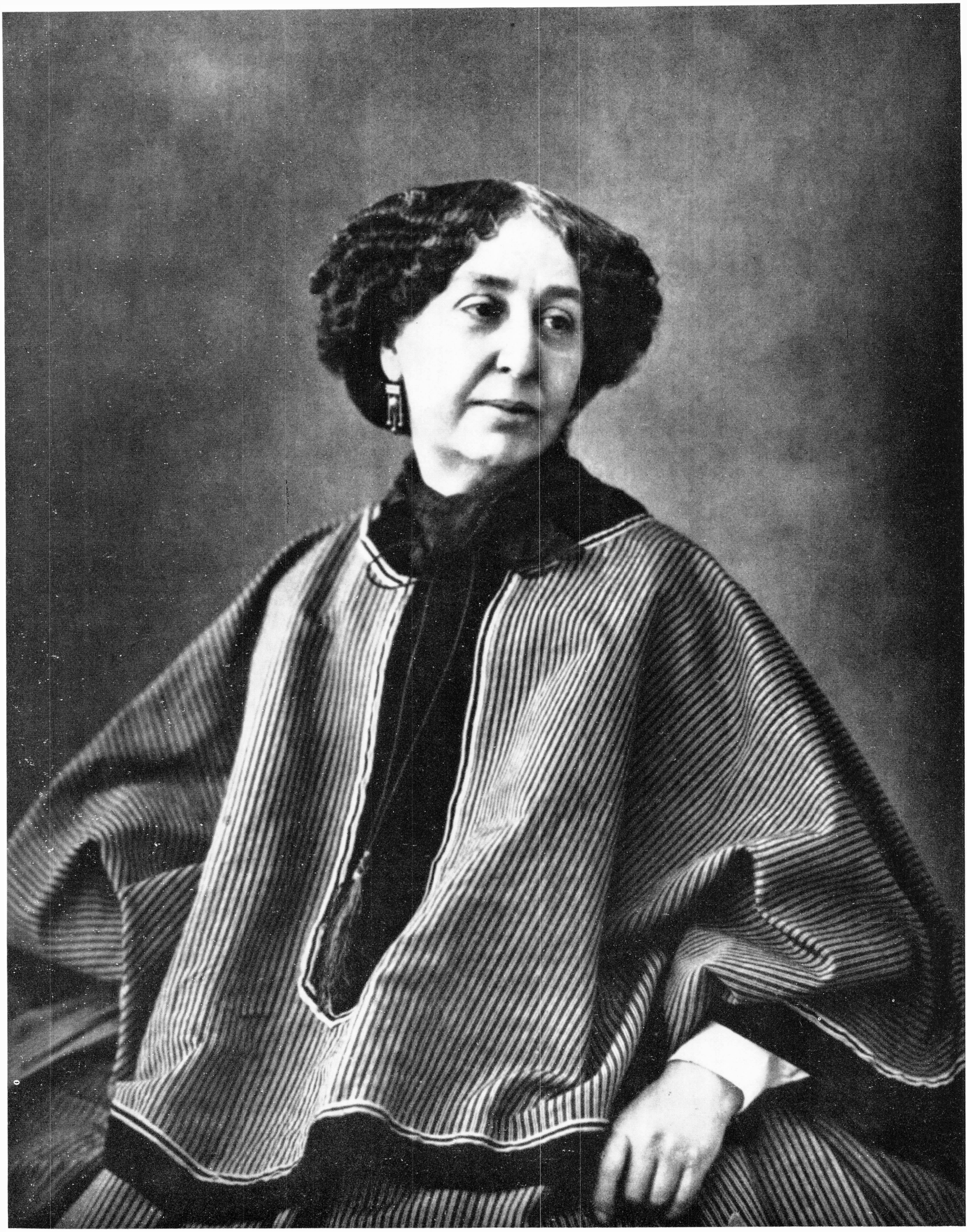
196 JULIA MARGARET CAMERON. Sir Henry Taylor, 1867

197 NADAR. Baron Taylor. Carbon print, *c.* 1865

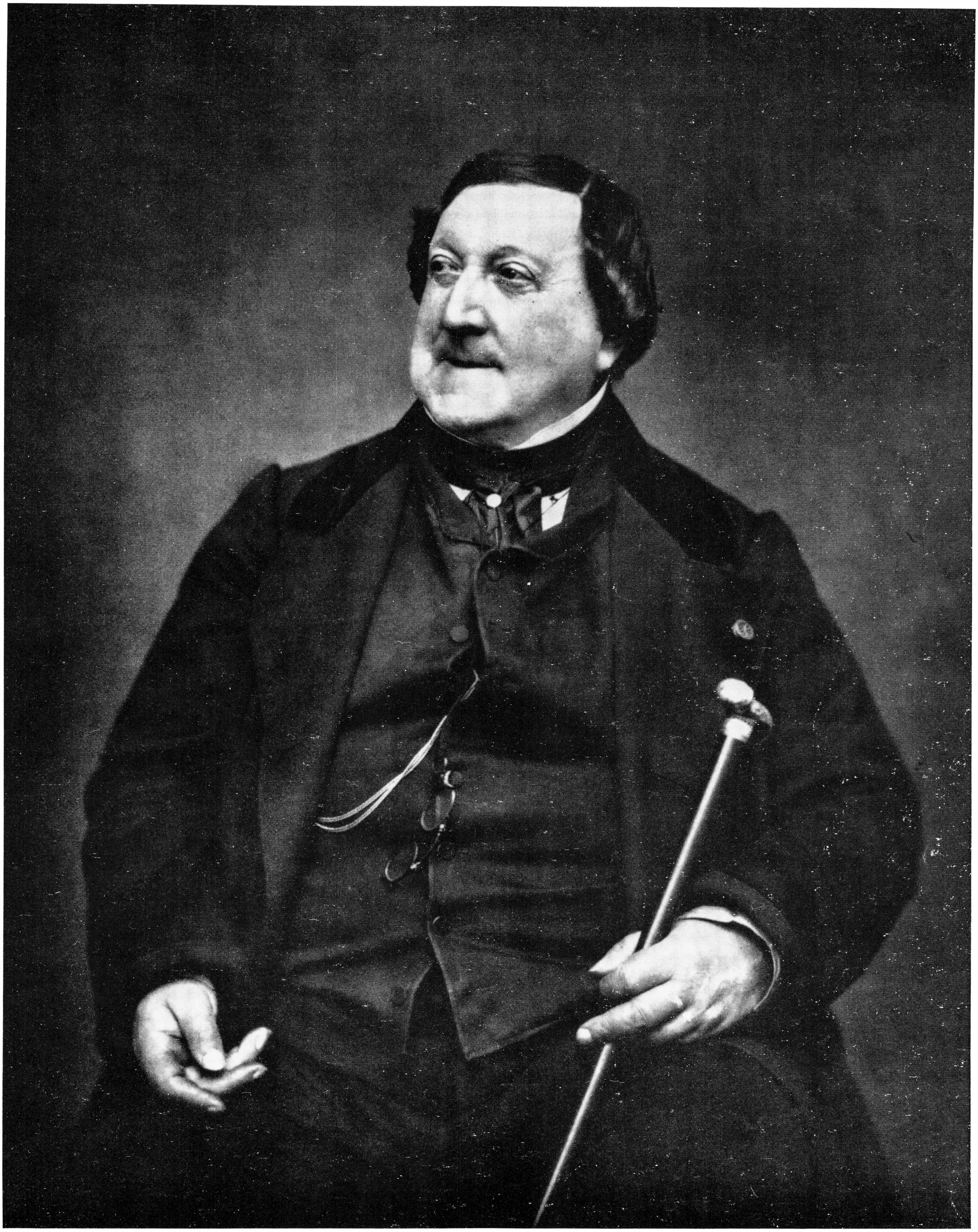
198 NADAR (FÉLIX TOURNACHON), portrait by an unknown photographer, 1856

199 NADAR. Victor Hugo on his deathbed, 1885

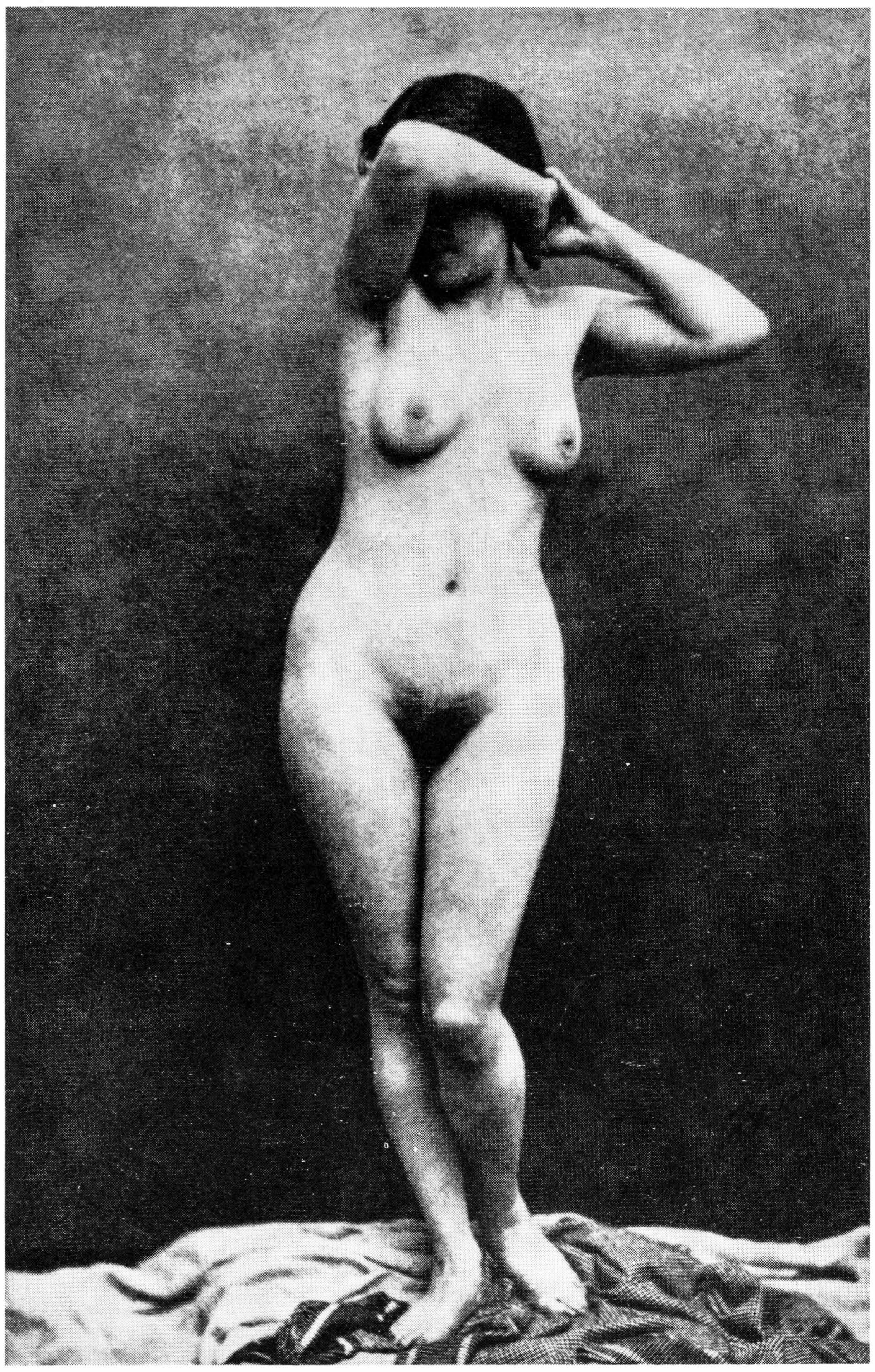


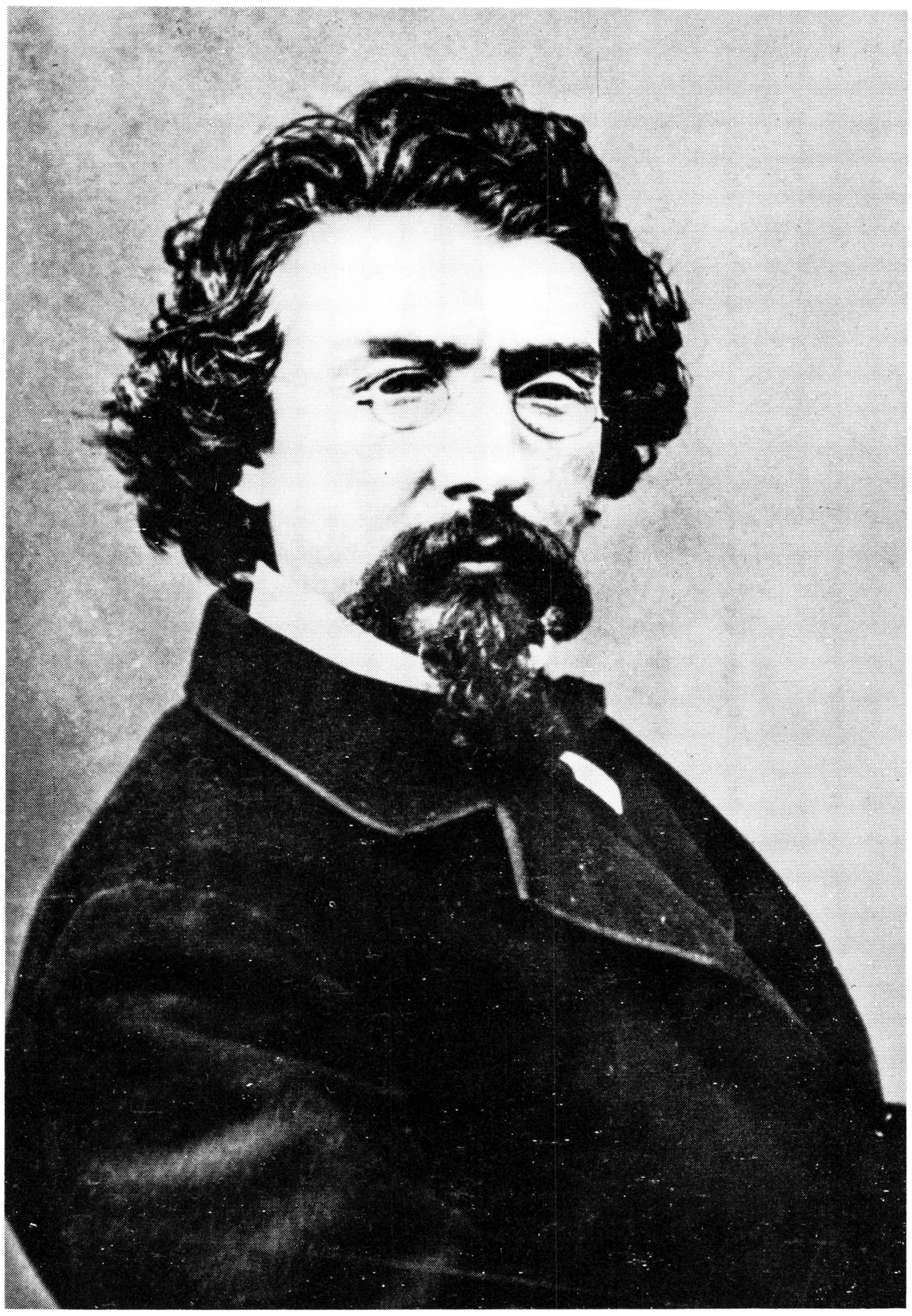


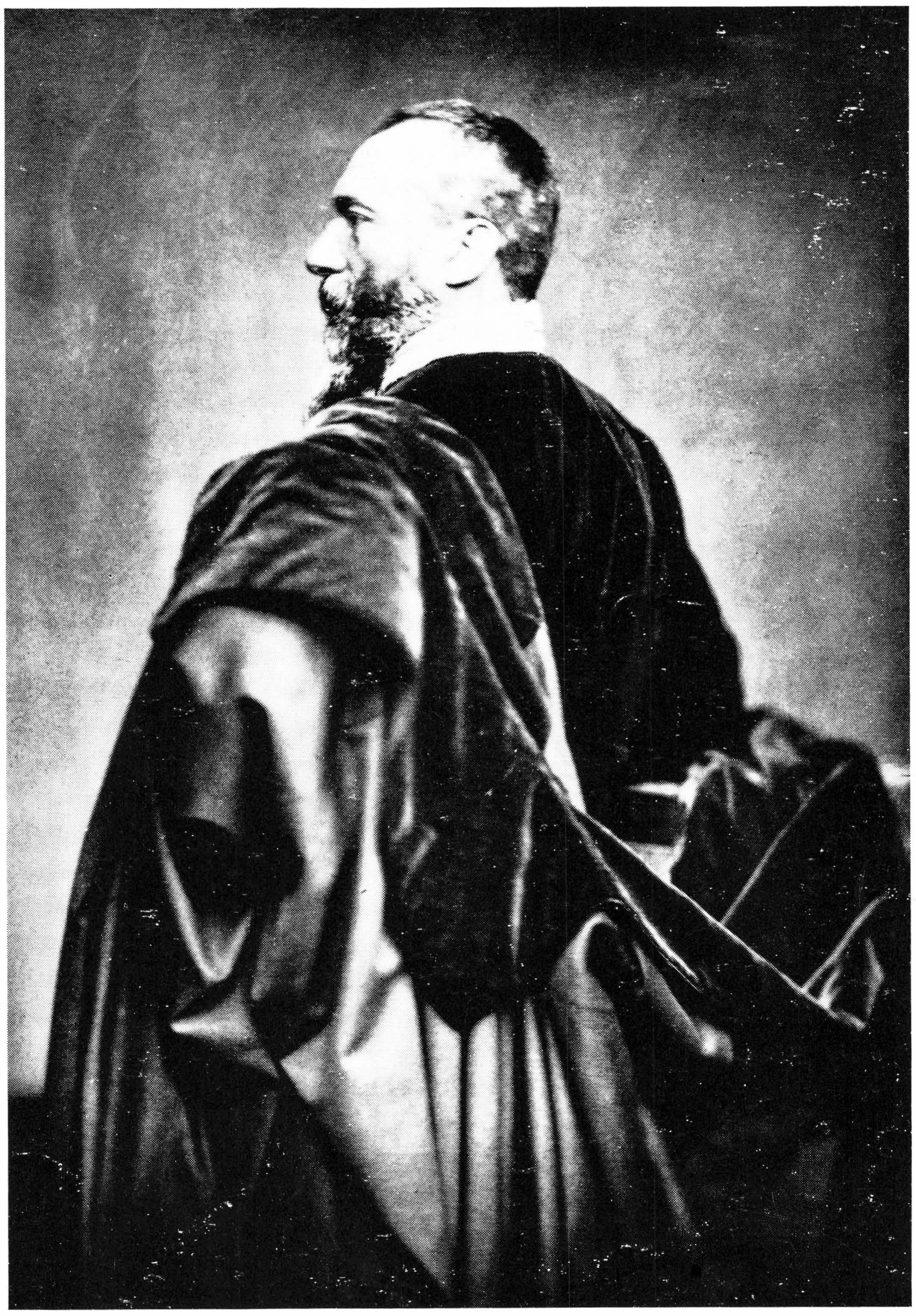
200 NADAR. 'George Sand'. Carbon print, 1864



201 ÉTIENNE CARJAT. Rossini. Carbon print, *c.* 1865





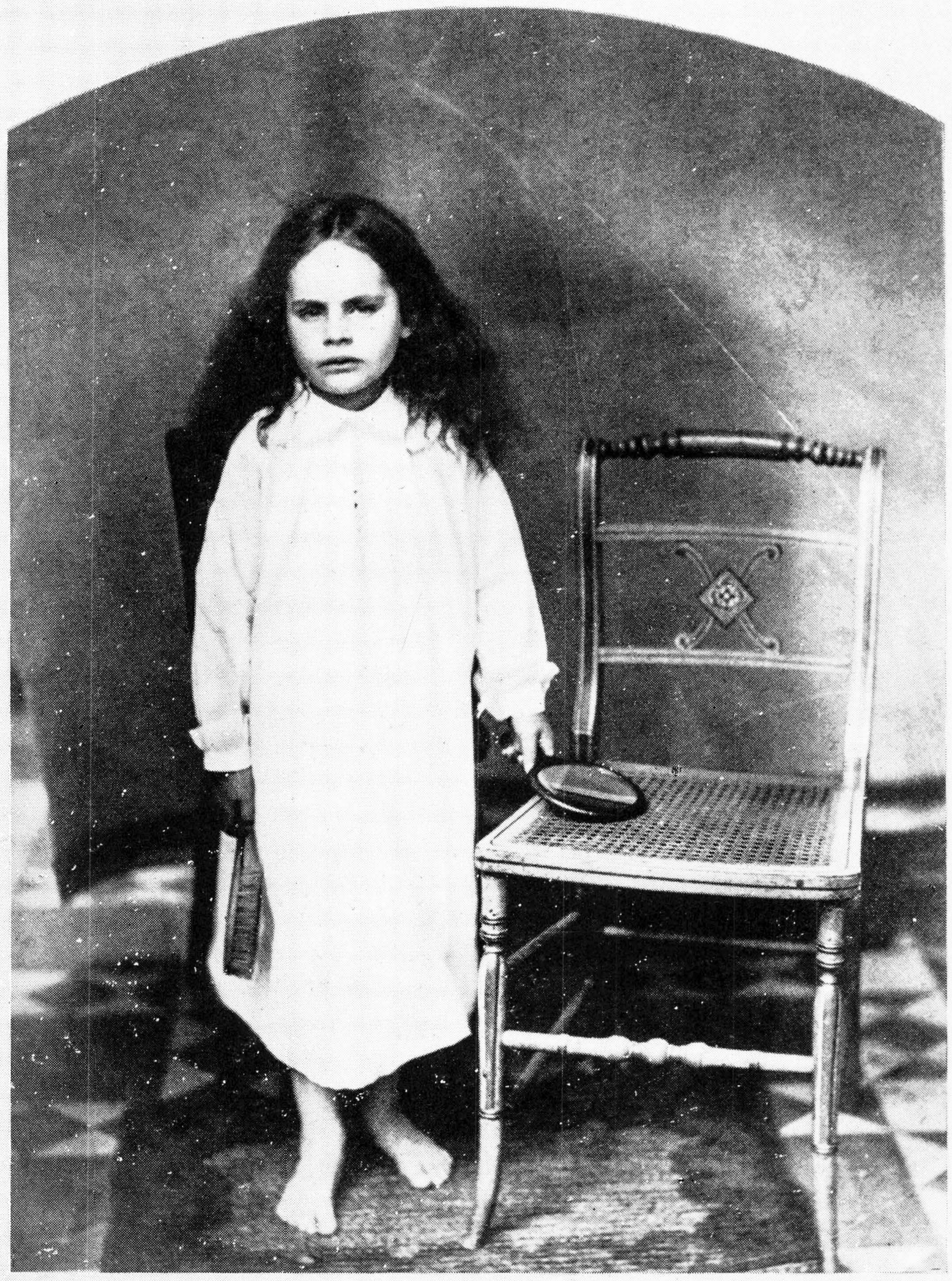


202 ÉTIENNE CARJAT. Baudelaire. Carbon print, *c.* 1863

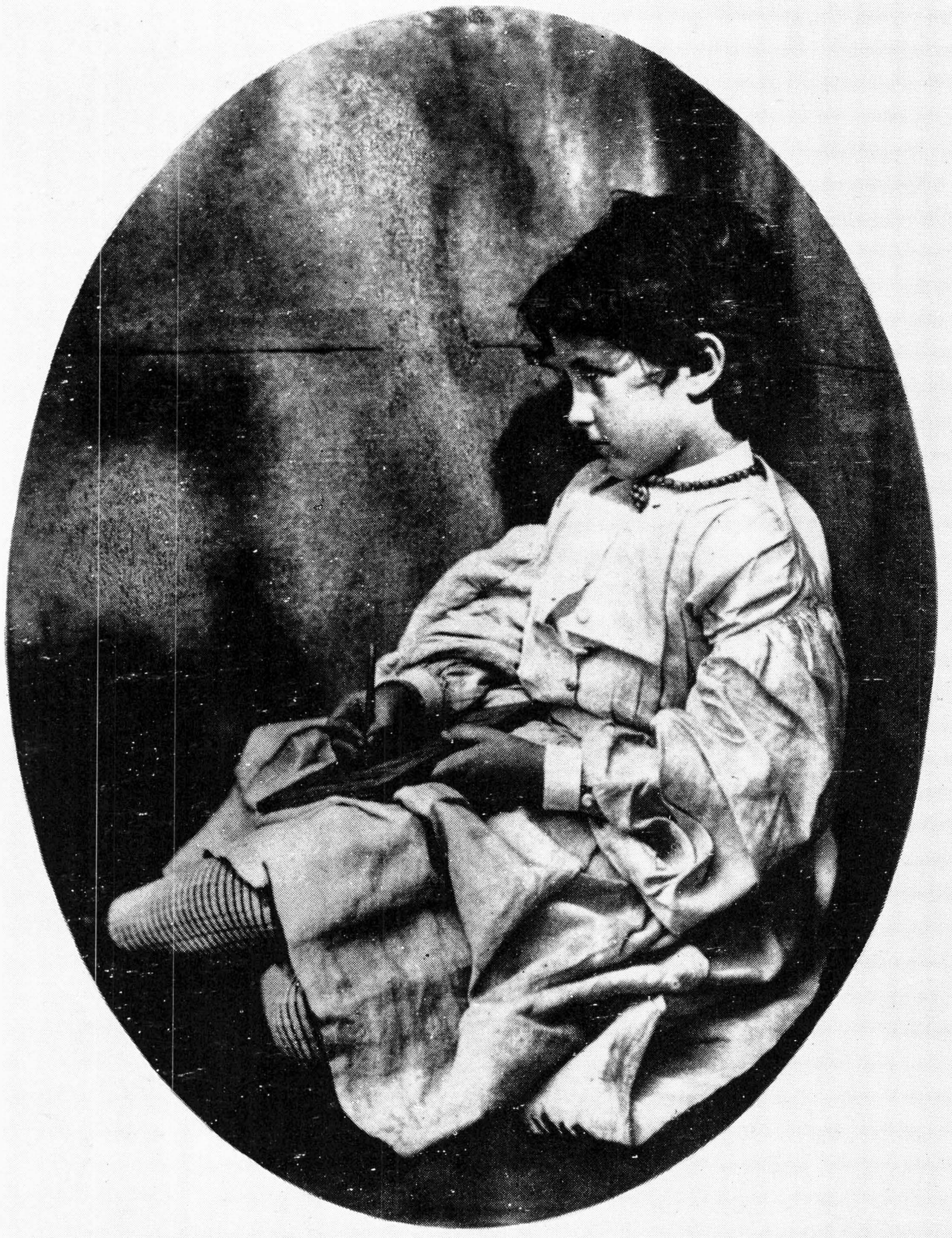
203 NADAR. The original 'Musette' of *Scènes de la vie de Bohème*, 1856

204 MATHEW B. BRADY, portrait by an unknown photographer, *c.* 1863

205 ADAM-SALOMON. Alphonse Karr. Carbon print, *c.* 1867

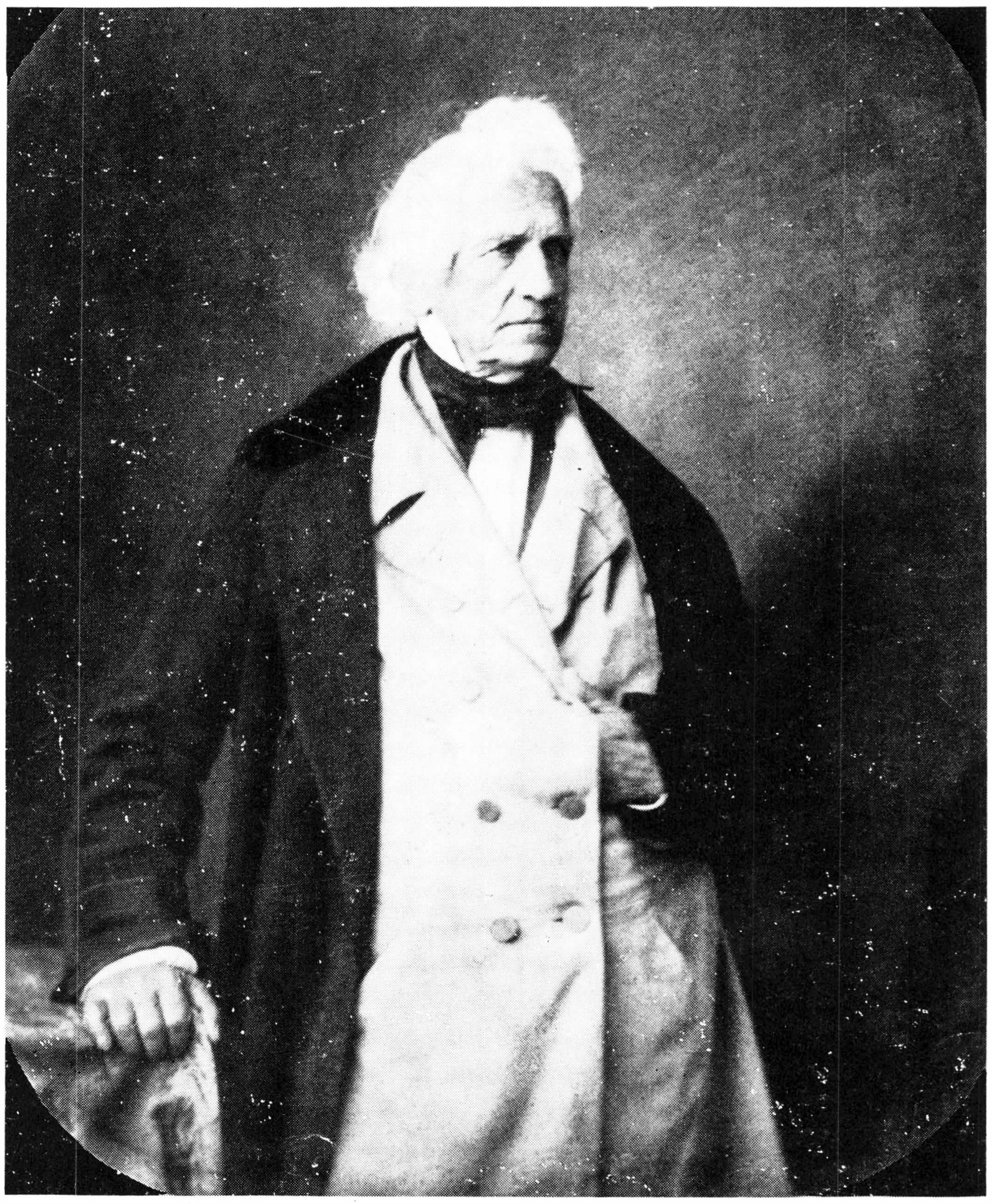


206 LEWIS CARROLL. 'It won't come smooth' (Irene Macdonald), 1863

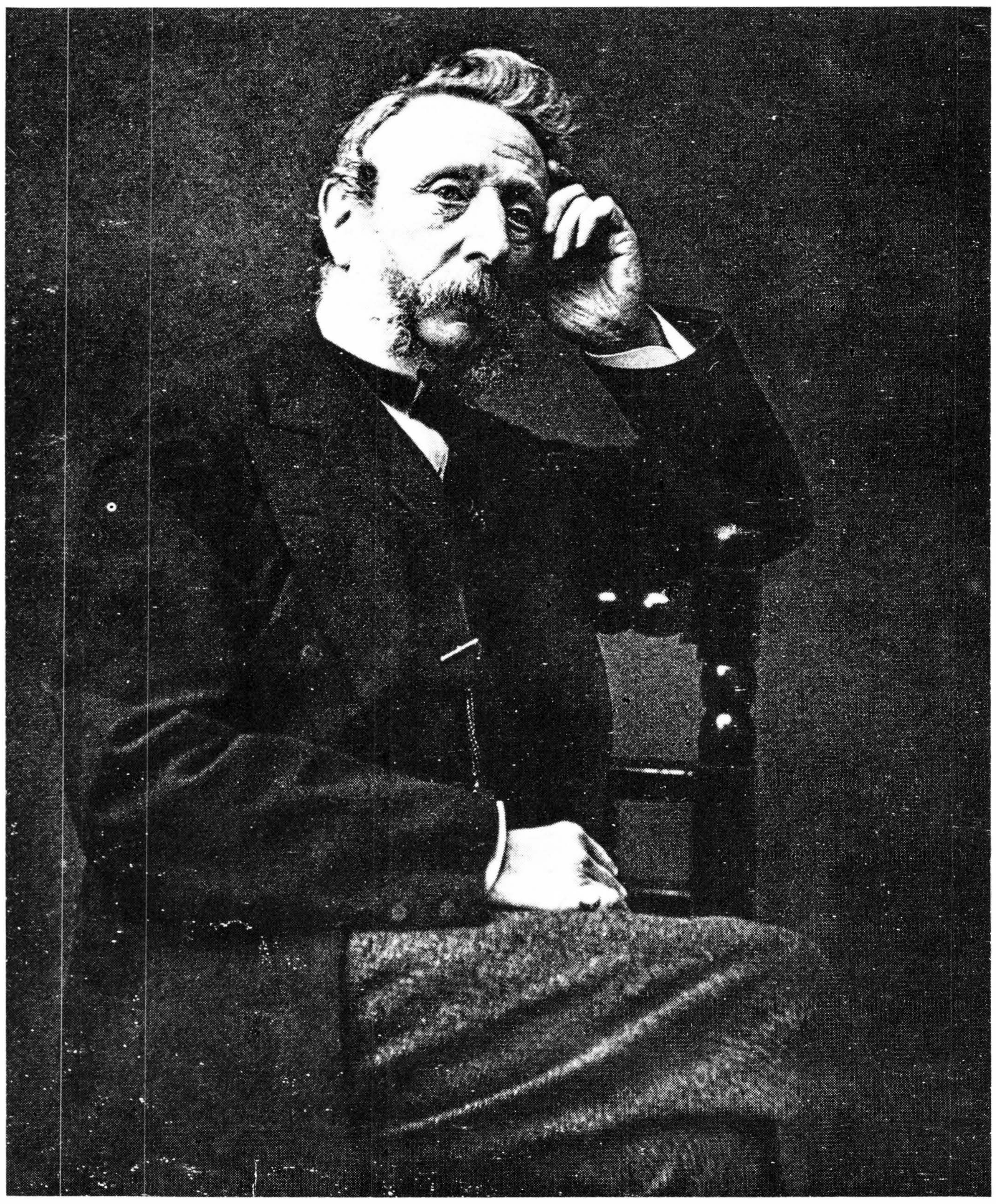


207 LEWIS CARROLL. Effie Millais, 1865

208 C. SCHWARTZ. The sculptor Christian Rauch, *c.* 1856



209 DR RICHARD LEACH MADDOX, portrait by W. E. DEBENHAM, *c.* 1880

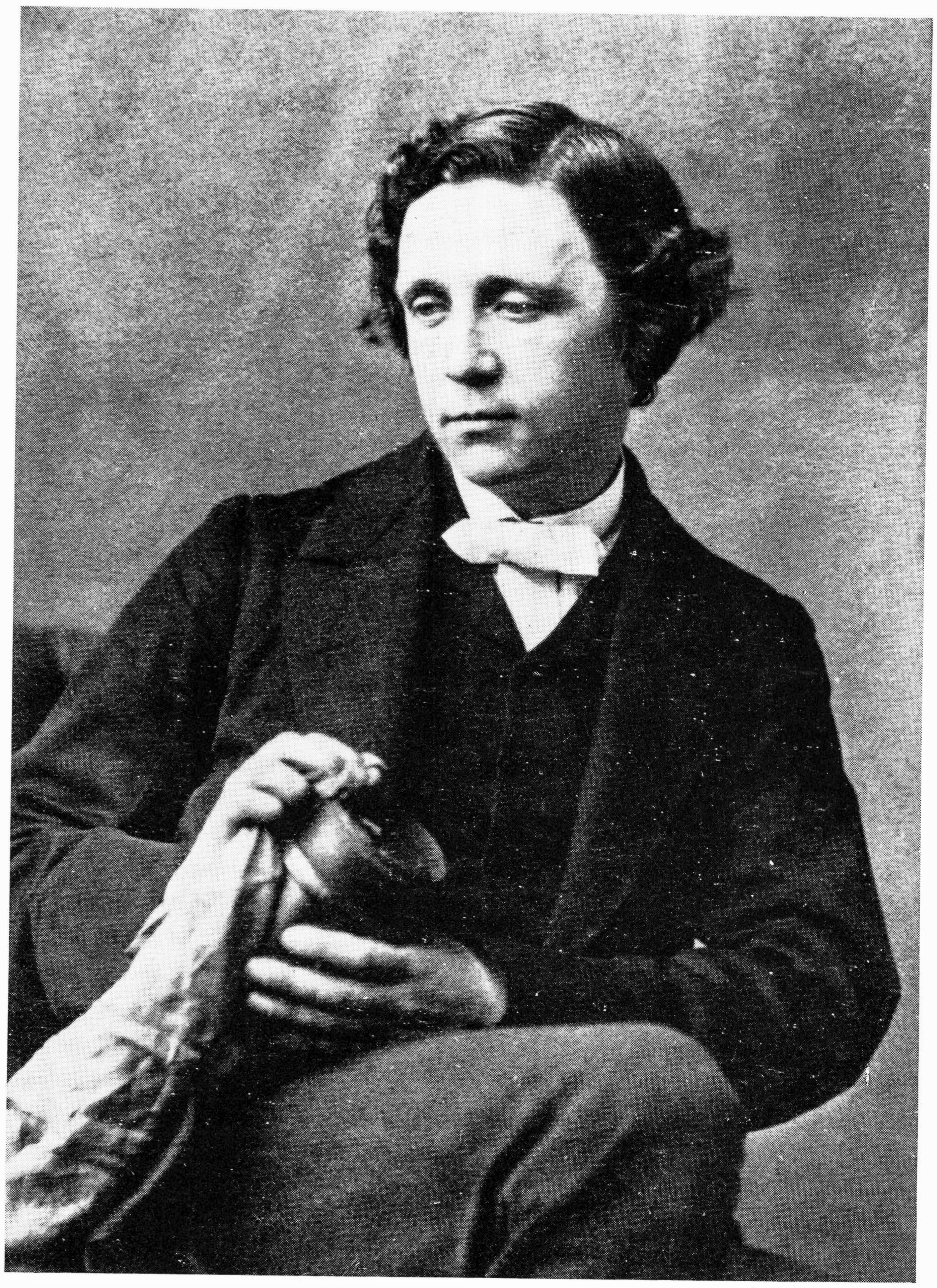


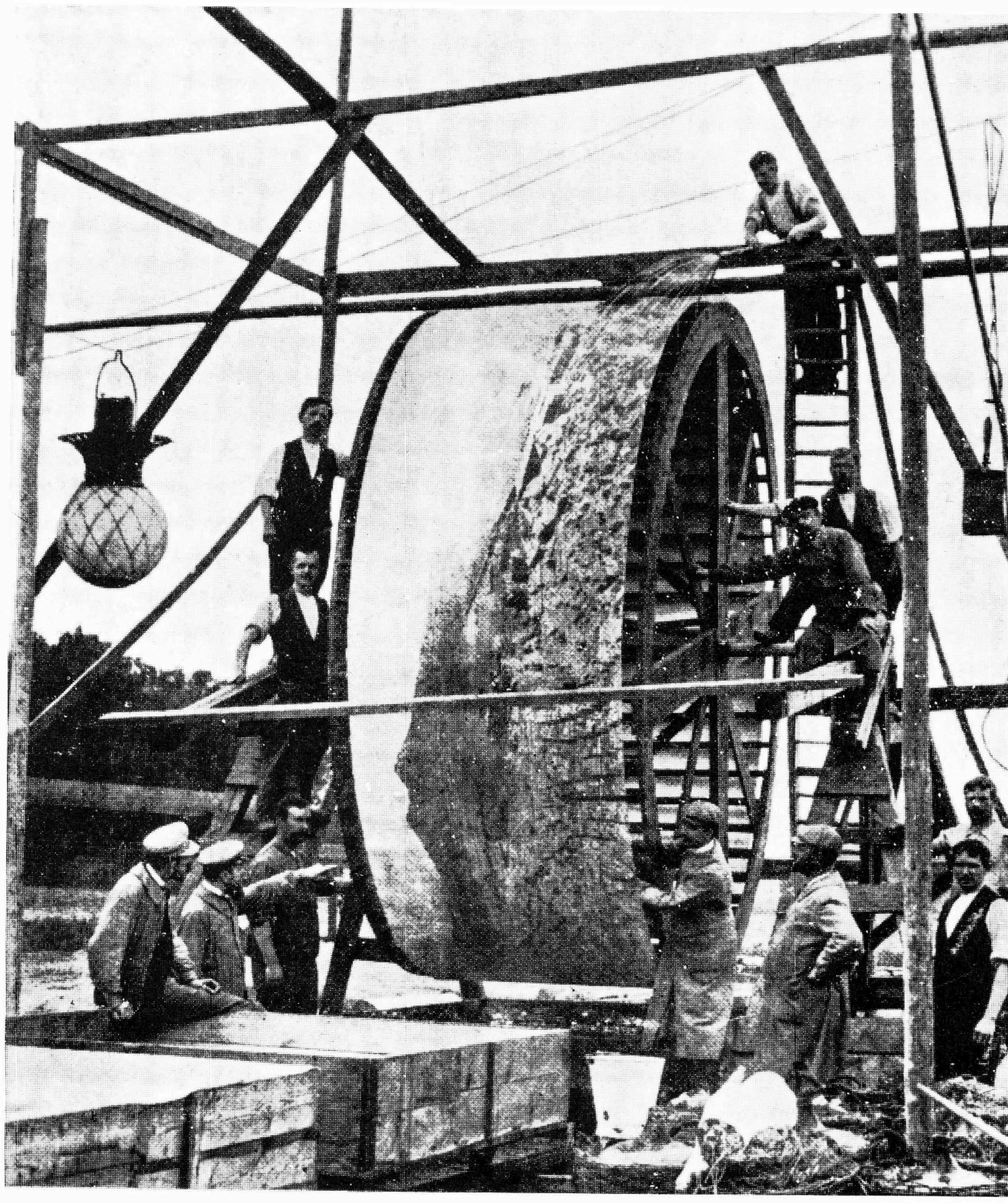
210 O. G. REJLANDER. Lewis Carroll holding a lens. Carte-de-visite, March 1863

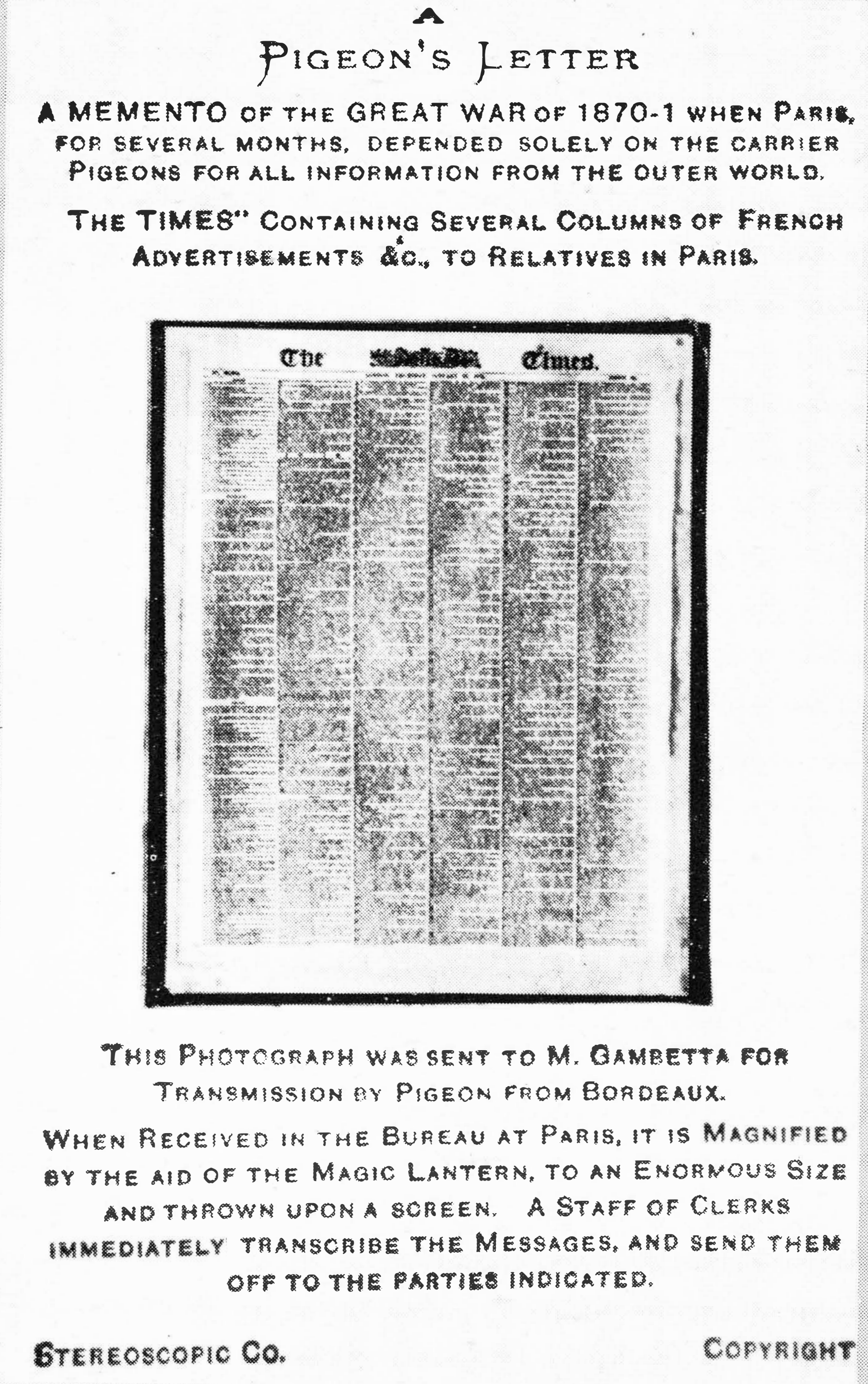
211 Mammoth panorama of the Gulf of Naples, 1903. Reproduction.

212 *The Times* pigeon-post letter, 19 January 1871. Original size 4 in. × $2\frac{1}{2}$ in.

213 Clerks copying pigeon-post messages during the Siege of Paris, 1870–1







A

PIGEON'S LETTER

A MEMENTO OF THE GREAT WAR OF 1870-1 WHEN PARIS, FOR SEVERAL MONTHS, DEPENDED SOLELY ON THE CARRIER PIGEONS FOR ALL INFORMATION FROM THE OUTER WORLD.

THE TIMES" CONTAINING SEVERAL COLUMNS OF FRENCH ADVERTISEMENTS &C., TO RELATIVES IN PARIS.

THIS PHOTOGRAPH WAS SENT TO M. GAMBETTA FOR TRANSMISSION BY PIGEON FROM BORDEAUX.

WHEN RECEIVED IN THE BUREAU AT PARIS, IT IS MAGNIFIED BY THE AID OF THE MAGIC LANTERN, TO AN ENORMOUS SIZE AND THROWN UPON A SCREEN. A STAFF OF CLERKS IMMEDIATELY TRANSCRIBE THE MESSAGES, AND SEND THEM OFF TO THE PARTIES INDICATED.

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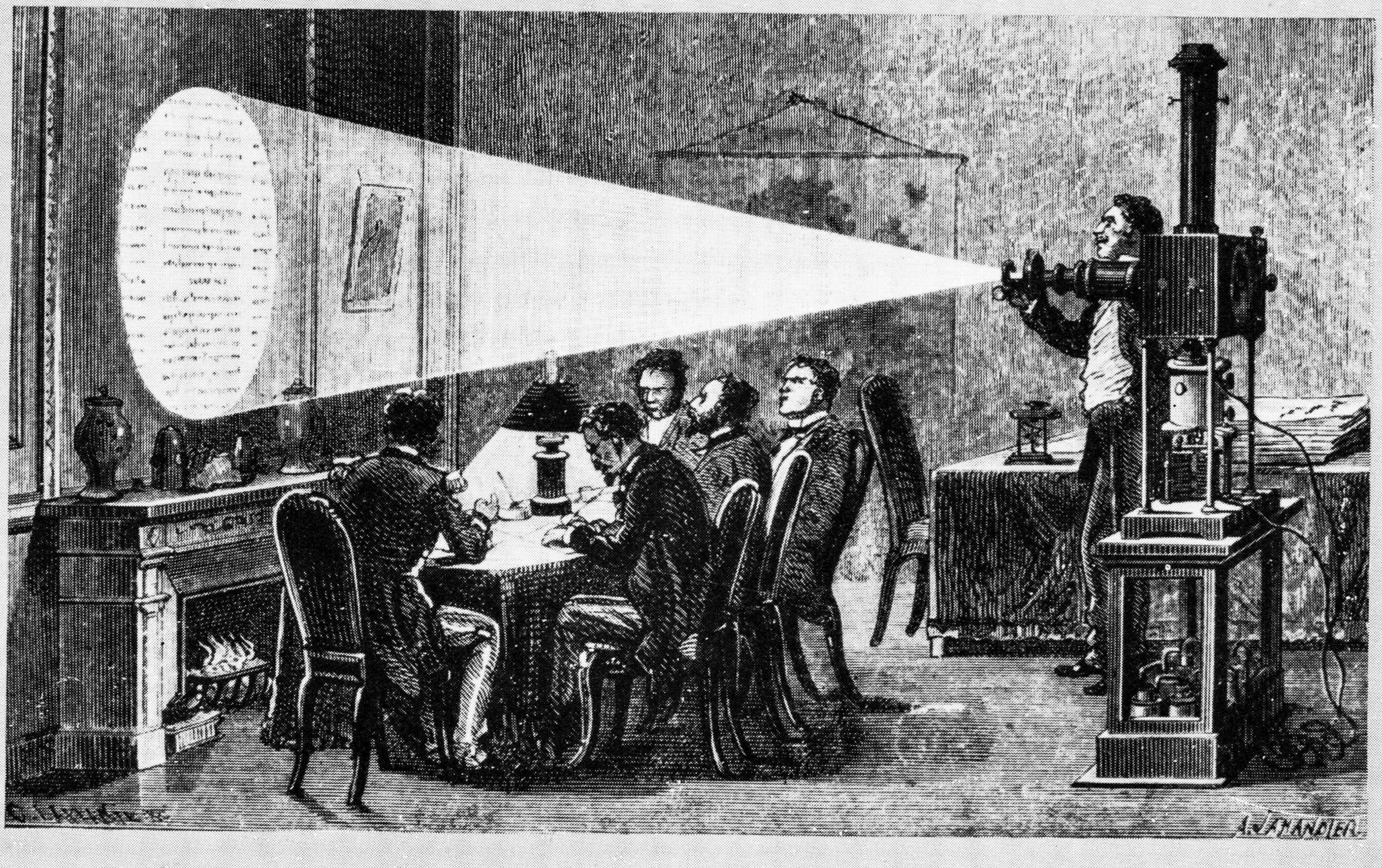
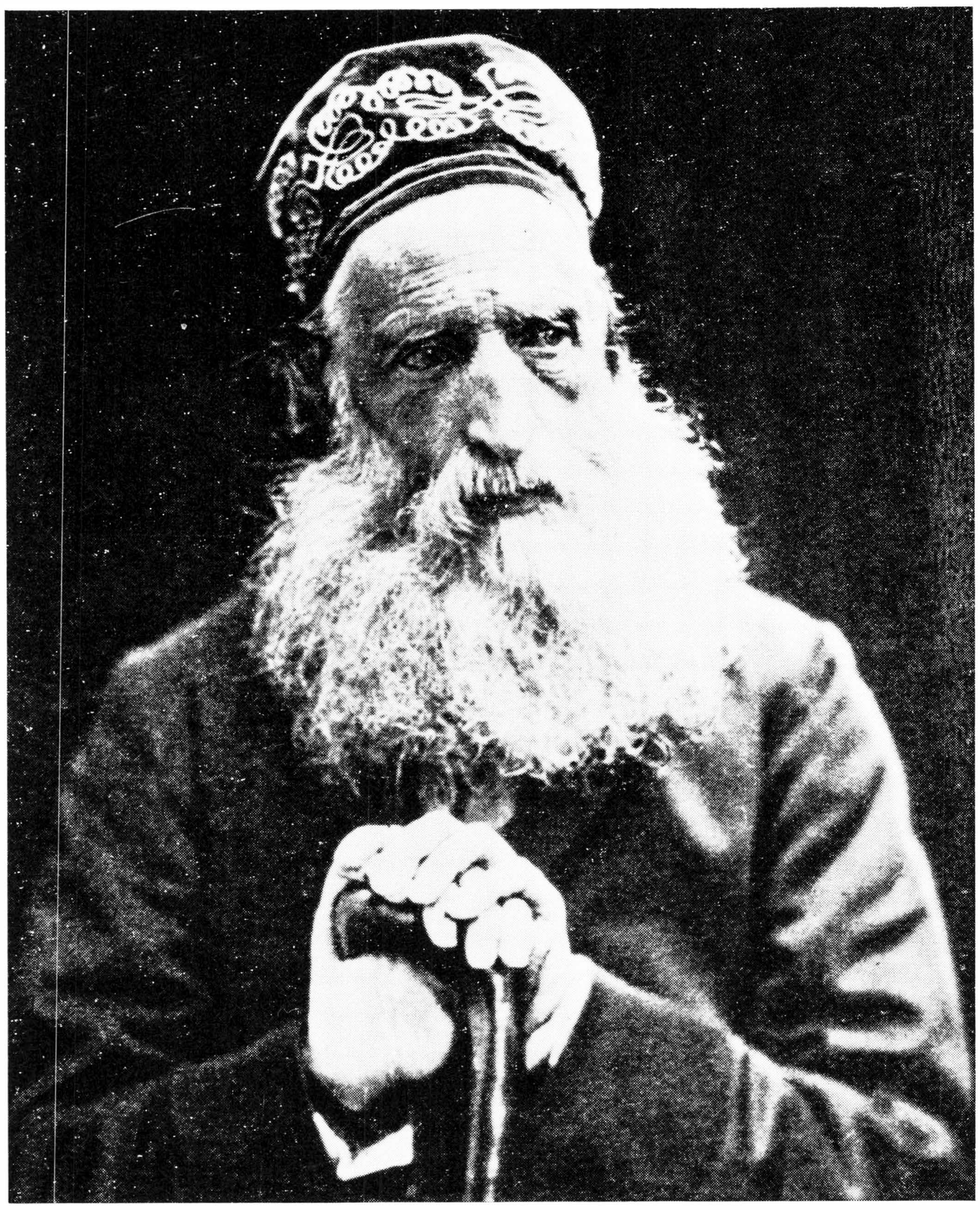


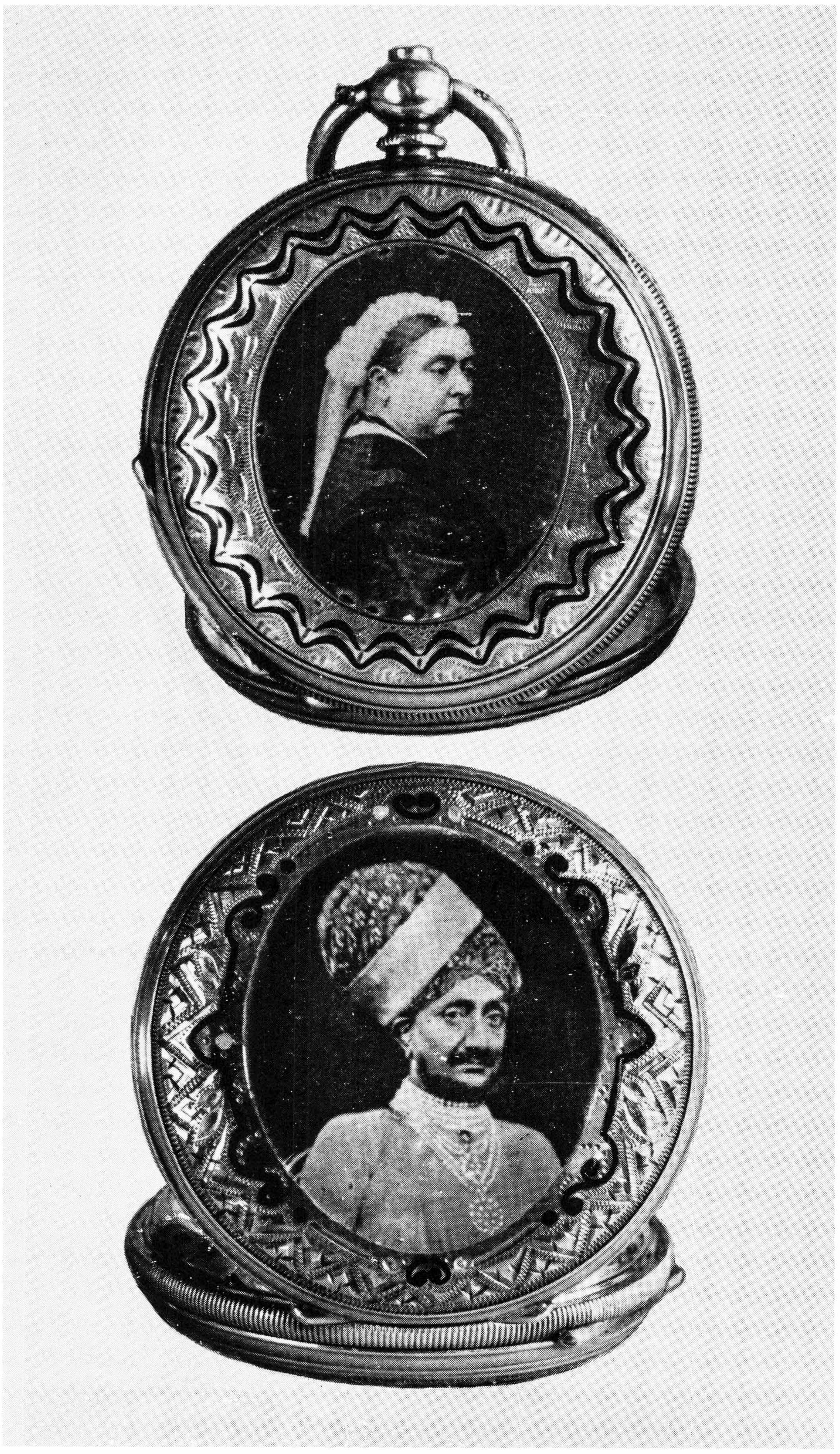


214 H. W. VOGEL, portrait by LOESCHER & PETSCH, *c.* 1895

215 MUNGO PONTON, *c.* 1879. Photogravure printed by KLÍČ in Vienna

216 ALPHONSE POITEVIN, photograph probably by PIERRE PETIT, *c.* 1861. Printed by POITEVIN's second carbon process

217, 218 Two pocket watches, each bearing an enamel photograph of Queen Victoria and an Indian ruler, 1887



Part V

THE GELATINE PERIOD

29 Emulsion papers and mass-production printing

The slowness of albumen paper, and its liability to fade, led several experimenters to try applying to paper emulsions similar to those evolved for dry plates.

Collodio-chloride paper. Shortly after Sayce and Bolton's publication of their collodion bromide emulsion for negatives, GEORGE WHARTON SIMPSON, editor of *The Photographic News*, introduced a collodio-chloride of silver emulsion paper[1] which was considerably more sensitive and permanent than albumen paper and, like it, was of the printing-out variety. In spite of its obvious advantages, however, no British firm undertook its manufacture, though in 1868 J. B. Obernetter of Munich successfully introduced it into Germany. In the 1880s and 1890s it was made by a number of firms and traded under the name of 'Aristotypie'. The emulsion was also used for positive pictures on opal glass.

Gelatine bromide paper. Gelatine silver bromide paper was invented and first produced in 1873 by PETER MAWDSLEY, founder and manager of the Liverpool Dry Plate & Photographic Printing Company. He recommended it, both for the production of paper negatives and for positive copies, in an article he contributed to *The British Journal Photographic Almanac for the year 1874*, stressing the advantages of the negative *paper* as compared with the weight and fragility of *glass* plates, and its lower price–it was 20-25 per cent. cheaper–as well as its great speed for positive printing by development. An exposure of a few seconds to gas or other artificial light was sufficient, and to Mawdsley the advantages of bromide paper for direct enlargement seemed obvious. However, his ideas came eight to ten years before their time, for it was only the new amateurs who were willing to try paper negatives and whose desire for small hand cameras led to a demand for enlarging. Professionals working with large plate cameras were content with the *status quo*, and so Mawdsley's emulsion paper shared the fate of Kennett's gelatine dry plate–both brilliant inventions lacking popular support.

Probably unaware of Mawdsley's earlier invention, which had not been secured by a patent, J. W. SWAN patented gelatine bromide paper in July 1879. He also recommended this development paper for contact printing and enlarging, and stressed its suitability for mass-production printing. 'To facilitate printing at a uniform and rapid rate, the sensitive paper may be used in long bands, and by means of automatic mechanism may be moved on step by step periodically through a space equal to the width or length of the print, the negative being screened from the light during the movement.'

By 1880 two makes of gelatine bromide paper were on the market–those of Mawson & Swan and of W. T. Morgan & Co. (later MORGAN & KIDD) of London, and in the following years numerous firms began to manufacture bromide paper, both in England and abroad. Only the inventor had abandoned it owing to lack of demand; in 1879 he restricted the output of his firm (now in London) to one special brand of gelatine dry plate, and collodio-bromide emulsion. Five years later the firm closed down altogether and Mawdsley emigrated to America. From about this time Morgan & Kidd claimed in advertisements to be the inventors of gelatine bromide paper, and to have produced it since 1874. Possibly Mawdsley had ceded his formula to them, but the invention, and its commercial introduction, were unquestionably his. Morgan & Kidd remained for many years the leading producers of bromide paper and were the first to start a large-scale printing and enlarging service for amateurs. By 1887 they had facilities to make 1,000 prints from one negative in 24 hours.[2] Their and other manufacturers' charges for bromide paper at that date were 2*s.* 3*d.* for a dozen whole-plate sheets, and 4*s.* 6*d.* for the same quantity 10 in. × 12 in.

The essential qualities of bromide papers were, and remain, their speed and the ease with which either contact prints or direct enlargements can be obtained by artificial light in a few seconds, and the absolute uniformity of the results.

Developed gelatine chloride paper. The invention of gelatine silver chloride paper is due to DR J. M. EDER and his brother-in-law CAPTAIN GIUSEPPE PIZZIGHELLI, both of Vienna, who published a pamphlet about their emulsion in 1881. This was also a development paper but considerably slower than bromide paper and therefore better suited to contact printing. Dr E. Just of Vienna began its manufacture towards the end of 1882; Leon Warnerke in London followed in 1889, and–to the accompaniment of a tremendous advertising campaign–the Nepera Chemical Co. of Yonkers, N.Y., brought out their 'Velox' gaslight paper in 1893. Contrary to the claims made at the time, this paper was not the invention of Nepera's founder and technical manager, the Belgian chemist Dr Leo Baekeland. Subsequently, many manufacturers made 'Velox' paper, which still remains a favourite contact paper, easily recognized by its characteristic blue-black tones.

Printing-out gelatine chloride paper. The first formula for gelatine silver chloride printing-out paper is due to CAPTAIN (SIR) WILLIAM DE W. ABNEY in 1882.[3] This paper, which gave a burnt sienna tint, was stated to be more than twice as rapid as albumen paper, and to be greatly superior to it in permanence. Like Simpson's collodio-chloride paper, its manufacture was first taken up by a German firm, Liesegang of Düsseldorf, who put it on the market under the same name of 'Aristotypie' in 1886.[4] This paper should not be confused with another gelatine silver chloride printing-out paper (with subsequent toning) introduced in March 1885 by JOSEPH BARKER of London.[5] In speed and permanence it was similar to Abney's paper, but although offered for sale immediately after its announcement[6] it also failed (at first) to arouse interest in England. Emil Obernetter successfully produced the paper shortly afterwards in Germany, but it was not until October 1891 that the Britannia Works (since 1900 Ilford Ltd) began the production of Barker's paper, using for the first time the abbreviation P.O.P. (printing-out paper); Eastman Kodak Co. followed in June 1892 with 'Solio' paper–still on the manufacturer's list.

Gelatine chloro-bromide paper. The invention of chloro-bromide gelatine paper is also due to Dr J. M. Eder, who published a description of this emulsion in *The Photographic News* in January 1883. The following year the Britannia Works put it into production[7] for Marion & Co., London, under the name 'Alpha' paper. Chloro-bromide paper, which is still manufactured by many firms, has some of the characteristics of both bromide and chloride paper: the sensitivity is somewhere in between, and it prints in a warm brown tone. Being considerably faster than chloride paper, it is eminently suitable for contact copying by artificial light, and after development is often toned. JOHN URIE of Glasgow, who used this paper in his automatic printing machine in 1885, stated that he could make 200 to 300 prints per hour by gaslight,[8] but as this rate of output may convey a false impression of the speed of the paper, it is necessary to explain that a large number of carte-de-visite negatives were printed simultaneously.

Average exposures recommended were 2½ to 3 minutes at 6 in. from the gas burner or oil lamp; after development the prints were put into a combined fixing and toning bath. The most astonishing feature of this paper was its cheapness: for 5*s.* one could buy a box containing 334 pieces of paper carte-de-visite size, or any of the following: 120 cabinet, 50 whole-plate, 36 sheets 10 in. × 8 in., 24 sheets 12 in. × 10 in., 16 sheets 15 in. × 12 in., 6 sheets 24 in. × 19 in.

Originally chloride and chloro-bromide papers were called 'gaslight paper' because they were sensitive enough to be printed by gaslight in the darkroom. Until then, printing had to be done out of doors. The only exception known to us is MARK CALOT of London, who as early as March 1854 advertised[9] 'positive paper sensitive enough to print by lamp or gaslight' at the price of 10*s.* 6*d.* per dozen sheets, 7½ in. × 9 in. The term 'gaslight' continued to be used until about 1930 (although electricity was, of course, the source of illumination) now indicating the *slowness* of these papers compared with bromide paper. Cheap, and simple in manipulation, they are still used for contact printing by developing and printing firms, while the much faster bromide papers find their main application in enlarging, which became the practice with the general introduction of 35 mm. and 2¼ in. × 2¼ in. cameras in the late 1920s.

MASS-PRODUCTION PRINTING

In spite of the many advantages of emulsion papers over albumenized paper, the change-over took place surprisingly slowly, and albumen paper held its ground with large firms until the end of the century. Though not as permanent and about twice as slow as the new printing-out papers, there were strong economic reasons for retaining it. It was advantageous to buy albumenized paper and sensitize it oneself, particularly as labour was cheap. Moreover, the change-over to new materials would have caused dislocation and wastage during the training period, considering that contact copying was always done by unskilled labour, usually women, who were preferred for this kind of work because their wages were only half those of men (10*s.* to 15*s.* a week). Mounting and spotting were also almost exclusively done by women, and their employment in photographic businesses was constantly increasing. In retouching, the economy through female labour was striking. For retouching a cabinet portrait head, leading studios used to charge 2*s.* 6*d.* to 5*s.*: similar work done by women cost only 4*d.* to 1*s.*[10]

> I think that about one-third of the photographic assistants are women [wrote C. Jabez Hughes in 1873].[11] There are many reasons, some too technical to be introduced here, that might be shown as to the desirability of women being more employed in photography than they are. It is an occupation exactly suited to the sex. There are no great weights to carry, no arduous strain of body or mind, it is neat and clean.

Male assistants doing work demanding more skill, such as sensitizing, developing, etc. (later on also done by women), earned on the average 40*s.* to 50*s.* a week; leading studio operators and first-rate retouchers in big firms could earn as much as £250 a year, but the normal wage was under £200. The usual working hours were from 8 a.m. to 6 p.m. with an hour off for lunch, but in the long summer evenings printing was often continued until 8 or 9 o'clock.

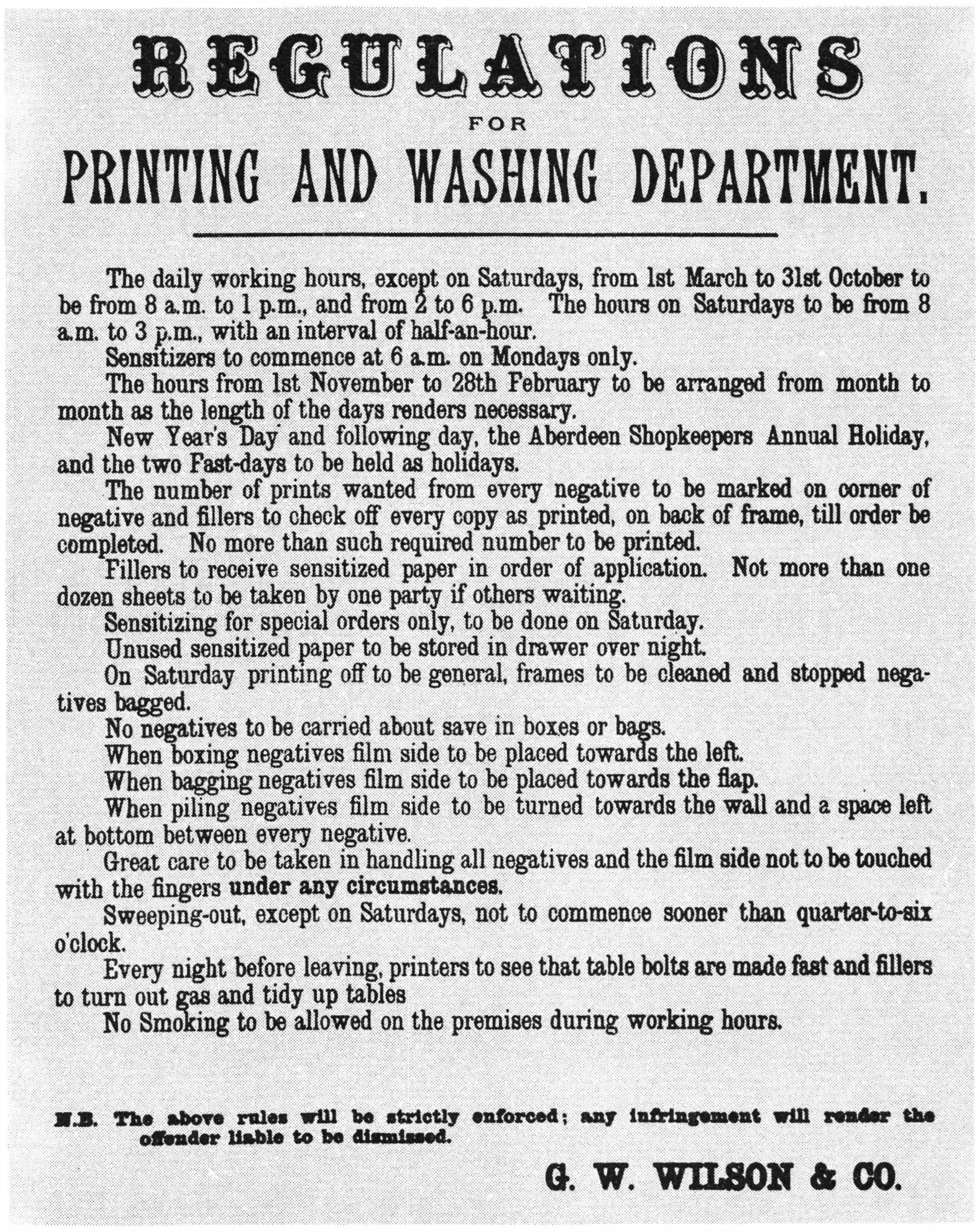
By the 1880s GEORGE WASHINGTON WILSON had become the world's largest publisher of photographic views and lantern slides, and his last surviving son Charles A. Wilson kindly supplied some interesting details concerning their printing works.

> Generally speaking, wet collodion negatives printed considerably more quickly than gelatine dry plates, owing to the coating's greater transparency. As the weather varied from day to day–as did the density of one negative compared with another–it is difficult to strike an average of how many prints could be got even from the same negative in one day. Taking a few figures of yearly output, and daily average number of sheets of albumenised paper used, it seems to work out at 2½ prints per negative per day, but some negatives might yield six or more per day in summer, and others only two or three, and these figures might be halved during the depths of winter. Indeed, there were days when no printing could be done at all, and the printers–all local women, who sometimes walked several miles to work–had to be sent home.
>
> In 1886, when both the St. Swithin's and Stanley Works were in operation, there might be 1500 or even 2000 printing frames out with dry plate negatives, and I should say that the average number of prints per day would vary from one to two, taking sunny days and dismal or stormy periods. I have had a thin negative on a bright day from which a print could be got off in say 15 or 20 minutes, and I have known very dense negatives which required a couple of days to get one print off.

This extraordinary slowness is the more remarkable in contrast to the quick development paper employed in Blanquart-Evrard's printing establishment at Lille thirty years earlier (described in chapter 15).

Pl 219 The daylight printing works at St Swithin's, Aberdeen, covered half an acre. The tables with the printing frames ran on rails and could be wheeled under the glass roof when it rained, while the stands had roller-blinds which could be lowered for protection. By deftly opening the back of the frames at each end alternately, the progress of the print could be examined, and if one end was darker than the other, a piece of wood with a bevelled edge was placed over it to allow the lighter edge to catch up.

> Two to three reams (each 480 sheets) of 24″ × 18″ albumen paper were used daily in summer. There were two qualities–Rive and Saxe[12]–the latter being a thicker paper than the former, and both were imported from Germany, which had practically a world monopoly of supplying albumen paper at that time.[13] The sensitizing was carried out by our firm. Every morning the sensitizers had to start floating sheets on the silver bath contained in large shallow porcelain dishes, allowing about two minutes before removing each sheet, when they were hung up by the corners to dry. The paper was then handed to the trimmers, who would cut it to the various sizes required. This work was carried out in rooms with yellow glass windows.
>
> After the prints had been developed and fixed, they were rinsed in large print-washing machines about 10 feet in diameter. They were spread upon circular revolving frames, and numerous jets of water sprayed from above and below, the whole machine being driven round by strong jets of water impinging on small metal buckets like a water-driven mill wheel. After washing, the prints were put on hot glazing machines.



REGULATIONS
FOR
PRINTING AND WASHING DEPARTMENT.

The daily working hours, except on Saturdays, from 1st March to 31st October to be from 8 a.m. to 1 p.m., and from 2 to 6 p.m. The hours on Saturdays to be from 8 a.m. to 3 p.m., with an interval of half-an-hour.

Sensitizers to commence at 6 a.m. on Mondays only.

The hours from 1st November to 28th February to be arranged from month to month as the length of the days renders necessary.

New Year's Day and following day, the Aberdeen Shopkeepers Annual Holiday, and the two Fast-days to be held as holidays.

The number of prints wanted from every negative to be marked on corner of negative and fillers to check off every copy as printed, on back of frame, till order be completed. No more than such required number to be printed.

Fillers to receive sensitized paper in order of application. Not more than one dozen sheets to be taken by one party if others waiting.

Sensitizing for special orders only, to be done on Saturday.

Unused sensitized paper to be stored in drawer over night.

On Saturday printing off to be general, frames to be cleaned and stopped negatives bagged.

No negatives to be carried about save in boxes or bags.

When boxing negatives film side to be placed towards the left.

When bagging negatives film side to be placed towards the flap.

When piling negatives film side to be turned towards the wall and a space left at bottom between every negative.

Great care to be taken in handling all negatives and the film side not to be touched with the fingers **under any circumstances.**

Sweeping-out, except on Saturdays, not to commence sooner than quarter-to-six o'clock.

Every night before leaving, printers to see that table bolts are made fast and fillers to turn out gas and tidy up tables

No Smoking to be allowed on the premises during working hours.

N.B. The above rules will be strictly enforced; any infringement will render the offender liable to be dismissed.

G. W. WILSON & CO.

Fig 52 Staff regulations at G. W. Wilson's printing establishment

Fig 52

Of course, such a large organization could only be run according to strict regulations – though Mr C. A. Wilson did not think that anyone was ever actually dismissed for breaking them.

It is obvious that a firm like Wilson's consumed enormous quantities of nitrate of silver and chloride of gold – the latter often made by dissolving a sovereign in aqua regia. For the twenty-three months from 1 January 1889 to 30 November 1890, for which figures are available, the nitrate of silver used cost £2,001, and the chloride of gold £468. Of this outlay, 48 per cent. was recovered from residues sold to refiners.

An equivalent to G. W. Wilson's organization today is the well-known photographic postcard publisher VALENTINE & SONS at Dundee, a firm which goes back to the days of engraving before photography, and remained in the forefront through five generations by constantly adapting itself to new ideas.

Nowadays, of course, the printing is done by automatic machines. Reference has already been made to Swan's and Urie's printing machines, but the AUTOMATIC PHOTOGRAPH COMPANY, New York, seems to have had the first really modern installation, in 1895. This was capable of exposing (by electric light) 245 cabinet pictures a minute, yielding in 'an ordinary day's work of ten hours' 147,000 prints.[14] The rapid printing was made possible by the high sensitivity of bromide paper, and by exposing a number of negatives simultaneously. The paper was fed to the automatic exposing box from a roll 1,000 yds long by 1 yd wide. The printing, developing, fixing, and rinsing arrangements differed in no essential point from those at Valentine's today, and the output, too, compares closely with the figures supplied by Valentine's (there being little difference in size between a postcard and a cabinet picture), which may convey an idea of the tremendous expansion and mechanization that has taken place in mass-production photographic printing. Eighty years ago Valentine's gave employment to forty workers, who turned out approximately 18,000 albumen prints weekly. In 1952 a staff of thirty-five in the photographic department produced half a million prints weekly at peak production for six months of the year, with a total annual output of fifteen million.[15]

The forerunner of the modern machinery just referred to was the steam-driven 'automatic exposure, developing and fixing machine' invented in 1860 by CHARLES FONTAYNE of Cincinnati, Ohio. With this, prints could be made from one negative at the rate of 2,500 an hour. By concentrating sunlight through a 7 in. condenser, as many as 12,000 prints an hour could be made, but this reduced the circle of illumination to 1½ in. diameter, restricting output to tiny pictures. The paper was passed in a continuous band under the negative in the printing box, and was then developed. It would be supposed that such machines would have been used by wholesale producers of photographic prints everywhere, particularly during the carte-de-visite craze, but the only time we hear of its use was for the production, by the inventor, of 100,000 portraits of President Lincoln immediately after his election in November 1860.

30 *Photography on film*

For a long time photographers had been desirous of replacing glass plates by a less heavy and fragile support, but it proved extremely difficult to find a material as transparent and smooth as glass, as light as paper, yet free from its impurities and grain. Before the ideal support for emulsion–celluloid–was manufactured in an even and thin quality suitable for photographic purposes, photography on film took two distinct forms–stripping film and flexible film, while simultaneously there was a short-lived revival of paper negatives.

STRIPPING FILM

Stripping film was a paper negative, with this difference: the paper was merely employed as a support for the emulsion, which was peeled off before printing, to avoid the grain of the paper being reproduced in the positive.

The advantage of stripping the sensitive layer from its support had first occurred to SCOTT ARCHER, who mentioned stripping by means of a solution of gutta-percha in his communication of the collodion process in March 1851. After improvements to facilitate the removal of the collodion layer, he patented the method in August 1855. It consisted in coating the finished and varnished negative with several layers of transparent gutta-percha. On immersion in water, the collodion separated from the glass, and Archer obtained 'tough and flexible photographic pictures capable of being used for the production of positive pictures'. The purpose of stripping was to reduce the weight of glass plates when on a long photographic tour, for, after stripping, the film could be kept in a portfolio and the plates used again. This did not, of course, help in ordinary day-to-day photography, and neither Archer's procedure nor that put forward a few months later by the REV. J. B. READE, using gutta-percha as a substratum, found much favour. The same applies to the method patented by ALEXANDER PARKES in May 1856, with a substratum of plain collodion, and J. A. FERRIER's method (patented in September 1857) by which a sensitive surface was formed on plain collodion which had been spread on a smooth surface of gelatine, gutta-percha, starch, or similar material and coated with albumen and sensitized. After washing and drying, this compound film was attached to a glass plate to facilitate exposure and processing. Afterwards, a solution of gelatine was poured over the negative and when dry, the top three layers were detached from the smooth gelatine or gutta-percha surface which remained on the glass. The albumen picture was thus sandwiched between a layer of collodion on one side and a layer of gelatine on the other. Stripping *positive* images on collodion, however, had two important applications–in ceramic photography (see chapter 28), and in the pigeon post during the Siege of Paris (see chapter 26).

In 1875 LEON WARNERKE took up again the idea of stripping. He treated glazed paper with several alternate layers of plain collodion and india rubber solution, which formed a transparent support for the sensitive collodion or gelatine emulsion, of sufficient thickness to allow the film after exposure to be easily separated from the paper and attached permanently to a moistened glass plate. The film was then treated like an ordinary negative on glass.[1] At his factory in London Warnerke made this material in sheets, and in long rolls for his compact roller slide, taking 100 exposures, which he introduced at the same time. Excellent results were obtained with this stripping film, but, being expensive to manufacture, it failed to win popularity.

THIÉBAUT's *papier peliculaire* (1883) was glazed paper coated with a substratum of collodion to hold the sensitive gelatine emulsion. After the negative had been fixed and dried, the film was stripped off and transferred to a glass plate from which prints were made.

GEORGES BALAGNY introduced yet another stripping film in 1883, which was manufactured by Auguste and Louis Lumière of Lyons. Balagny used very thin transparent paper first powdered with talc, then coated with collodion, and lastly with gelatine emulsion. When the negative was dry, it was transferred to a sheet of gelatine, and the paper peeled off.

There were several other kinds of stripping film on the market, but it was not used to any extent until GEORGE EASTMAN introduced it for the Eastman/Walker roller-slide in 1886 and the Kodak in 1888. Its life was very short, for only a year later the Kodak was loaded with nitro-cellulose roll-film. Eastman's stripping film, which continued to be manufactured until 1891 for use in the Eastman/Walker roller-slide, consisted of a paper base, a layer of soluble gelatine, a layer of collodion, and finally the sensitized gelatine emulsion. After exposure, the roll was cut up into the individual negatives, and developed and fixed in the usual way. The emulsion side of the film strips was then attached to glass plates, coated with glycerine to facilitate subsequent removal of the image. When hot water was applied to the paper, the soluble gelatine under it was dissolved and this permitted the paper to be stripped off. As the image on the glass was reversed, it had to be retransferred to a moistened gelatine sheet, and was then ready for printing. The manipulation was, in a way, a combination of Warnerke's and Balagny's methods, but more complicated than either. For this reason the Eastman Kodak Co. undertook the processing of the film themselves.

REVIVAL OF PAPER NEGATIVES

Paper negatives, though undoubtedly a retrograde step, were far from being simply a revival of the old calotype. Great improvements had been made in the speed of the sensitive coating, and in the quality of photographic paper, which was specially manufactured of a close, fine texture. Moreover, while in the calotype process the image was formed in the structure of the paper itself, it was now produced in the gelatine emulsion, the paper acting merely as a support.

When PETER MAWDSLEY put gelatine bromide negative paper on the market in 1873, its introduction was premature, but after 1880 several firms went over to its manufacture, in particular, Morgan & Kidd and Warnerke & Co. in London, who made sheets 15 ft × 25 in., which were cut up into single sheets in sizes suitable to fit standard camera darkslides, or into long bands for use in patent roller-slides such as Warnerke's.

A particular stimulus to photography on paper negatives was given by the EASTMAN/WALKER roller-slide, loaded with sufficient negative paper for twenty-four exposures, which was introduced in the U.S. and in England in the summer of 1885. The negative material was fine grain paper coated with gelatine emulsion. After developing and fixing, the negatives were made transparent for printing by oiling with paraffin or boiling castor oil, this process being analogous to the waxing of calotypes.

To improve the transparency without the necessity for this unpleasant operation, Warnerke a few months later introduced a very original method of abolishing grain: paper coated with emulsion on *both* sides. He reasoned that any imperfections in the paper imprinted themselves on the reverse negative in an inverse manner to the faults in the paper (i.e. the faults would cancel each other out), and therefore a print made through the double negative would be perfectly free from grain. His paper was very transparent, impervious to water, and was considered an improvement on Eastman's paper. Warnerke expected it to mark 'the beginning of the paper era'.[2] This could still be said as late as September 1885. But three years later the arrival of celluloid put an end to paper photography.

FLEXIBLE FILM

The first suggestion for flexible film of sufficient strength to dispense with a support came from ALEXANDER PARKES, who included flexible as well as stripping film in his patent of May 1856. His film of several layers of plain collodion never found application, but with this idea Parkes laid the foundation for the many flexible film supports which were devised in the 1880s, the most important of which was celluloid. This material was another invention of Alexander Parkes (1861) and originally named after him 'Parkesine'.

The various kinds of flexible film introduced before celluloid were not very satisfactory, with one exception. FERRIER of Paris made a combined film of gelatine and collodion (1880) but occasionally the expansion of the gelatine in the developing and fixing baths caused the collodion to crack. The REV. H. J. PALMER of Liverpool and F. WILDE of Goerlitz suggested in 1878 a substratum of plain gelatine under the gelatine emulsion, but these films had the same defect as the tanned gelatine film introduced by PROFESSOR E. STEBBING of Paris in 1881, in that they were all liable to expand in the developing solution, sometimes to double their area, with consequent distortion on drying. Another disadvantage of all these flexible films was their extreme slowness in drying (12 to 24 hours).

The collodion and hardened gelatine films coated with gelatine emulsion which ALFRED PUMPHREY brought out in 1882 (patented April 1881) were considerably better than any of the above-mentioned, and established themselves as a commercial article in spite of being a trifle more expensive than gelatine dry plates. A drawback was that they had to be mounted for developing and fixing, as they had a tendency to curl and twist in water, and they also had to be attached all round their edges to a board for drying. In the darkslide they were held in position by special metal sheaths (such as are in use today) which Pumphrey was probably the first in the world to manufacture. They could be used in any standard plate camera, but were specially devised for Pumphrey's own magazine cameras, patented in April and November 1881 (see chapter 31). The chief advantage of Pumphrey's films was, of course, their light weight. A dozen $8\frac{1}{2}$ in. × $6\frac{1}{2}$ in. films weighed only 3 oz. as against 66 oz. for glass plates of this size. GEORGES BALAGNY introduced flexible sheet film in France in 1886. In the same year F. H. FROEDMAN of Dublin patented a flexible film consisting of a substratum of bichromated gelatine which had been hardened by light, and then coated with sensitive emulsion. This film was marketed by the Vergara Film Company in London, in 1887, but was rather expensive and found little demand.

Stripping films and these early flexible films were somewhat unreliable. With the former there was always a certain amount of danger of damaging the film when stripping it; with the latter, the difficulty lay in the slow and uneven drying.

Celluloid had been suggested for photographic purposes by M. H. FOURTIER and L. DAVID in 1881 and 1883 respectively, but at that time it was thick and streaky. Manufacturers could not be prevailed upon to prepare the substance thin enough to render it applicable to photography. They argued that there was not a sufficiently remunerative market to warrant the design of special machinery. Consequently experimenters were forced to prepare their own imperfect film bases.

Celluloid, invented by Alexander Parkes in 1861, is derived from a substance known chemically as cellulose. The name 'celluloid' was registered in 1873 as a trademark in U.S.A. and Great Britain by JOHN WESLEY HYATT of the Celluloid Manufacturing Company, Newark, New Jersey. Hyatt had for some years been persuaded by JOHN CARBUTT to manufacture thin sheets of celluloid, and succeeded in 1888 in producing clear sheets in uniform thickness of $\frac{1}{100}$ in., which answered perfectly the demand for a new photographic base. They constituted, as John Carbutt announced before the Franklin Institute in November 1888, 'the most complete and perfect substitute for glass yet discovered on which to make negatives and positives. . . . Its great merit does not alone lie in its lightness, toughness and flexibility, but in that its treatment in development etc. is precisely that of a glass plate. When the negative is washed, it is hung up by a spring clip to dry, and is then ready to be printed from.'[3]

John Carbutt was an English photographer who had emigrated to America. He claimed to have been the first person in the United States to manufacture gelatine dry plates in 1879, at his works in Philadelphia, and now (1888) became the first person in the world to introduce emulsion-coated celluloid films, called 'Carbutt's flexible negative films'.[4] The price ranged from 65 cents for a dozen $3\frac{1}{4}$ in. × $4\frac{1}{4}$ in. cut films to 2 dollars 50 cents for a dozen $6\frac{1}{2}$ in. × $8\frac{1}{2}$ in. The Celluloid Manufacturing Company produced 20 in. × 50 in. sheets for Carbutt and other plate makers, and in the early years of this century supplied it in rolls 300 ft long × 21 in. wide, and only $\frac{1}{200}$ in. thick.

Eighteen months before the Celluloid Manufacturing Co. introduced their perfected celluloid for Carbutt's cut film, the REV. HANNIBAL GOODWIN, also of Newark, applied for a patent (on 2 May 1887) for a transparent roll-film made of nitro-cellulose and camphor, i.e. celluloid. His claim was not specific enough for the patent examiners and the patent was not granted until September 1898 after various revisions and delays for which Goodwin's acute shortage of money was partly responsible. In the meantime the Eastman Company had captured the market with a nitro-cellulose roll-film similar to Goodwin's: some time after his application, H. M. REICHENBACH of the Eastman Company applied for a patent which, like Goodwin's, included a 'non-curling' layer of hardened gelatine on the back of the celluloid. But Reichenbach provided an exact formula and his patent was granted on 10 December 1889; the film had already gone into production four months earlier. Goodwin, on the other hand, had not raised sufficient money to embark on the manufacture of his film until 1900, and before production had begun he met with an accident and died. Thereupon the well-known firm of Anthony of New York acquired a controlling interest in The Goodwin Film & Camera Co., which began to produce the film in December 1902. Simultaneously they sued Eastman Kodak Company for infringement on the ground that their manufacture of celluloid film had departed from Reichenbach's formula and was made according to Goodwin's. A very long, important, and complicated lawsuit followed, which occupied the courts for twelve years and was documented in 5,500 printed pages by the time it was finally settled in March 1914. The Appeal Court then not only held that Goodwin's application filed in 1887 'disclosed for the first time the fundamental and essential features of a successful rollable film' but also that his specification had been infringed by the Eastman Company, who were 'ordered to make an accounting and settlement of its profits from the sale of the infringed film'.[5] The Eastman Kodak Co., who had a virtual world monopoly in roll-films,[6] settled with the Ansco Company, now the owners of Goodwin's patent, for five million dollars in cash.

With this transparent roll-film invented by Goodwin and popularized by Eastman, the modern era of photography had begun. The only change there has been in film material since then is that the highly inflammable nitro-cellulose began to be replaced by non-inflammable cellulose acetate about 1930.

A spool of Eastman roll-film (24 exposures) cost in 1889:

3¼ × 4¼ *inches*	4*s*	0
9 × 12 *cm*	5*s*	0
4 × 5 *inches*	6*s*	6

Spools of 48 exposures were double the above prices.

In 1900 the price of the new Daylight-Changing Cartridge Film, sold in spools for 12 exposures, was 3*s*. for the 3¼ in. × 4¼ in. size, and 3*s*. 9*d*. for the 4 in. × 5 in. size.

The 2¼ in. × 3¼ in. size first introduced with the Kodak No. 1 'Panoram' camera in 1900, and the most commonly used roll-film size today, cost 1*s*. 9*d*. for a 12-exposure spool.

In 1889 the prices of cut sheet film per dozen were 3*s*. 9*d*. for the 3¼ in. × 4¼ in. size, 4*s*. 6*d*. for 9 cm. × 12 cm., and 5*s*. 6*d*. for 4 in. × 5 in.

31 *Hand, pocket, and detective cameras*

The characteristics of the new apparatus which began to flood the market after 1880 were compactness, simplicity in manipulation, and light weight. There were four main types of camera–change-box, magazine, roll-film, reflex–in all of which it was possible to take a large number of plates or films in quick succession, which meant constant readiness for action. Of the many available sizes, the quarter-plate established itself as the favourite for amateurs in Anglo-Saxon countries, 9 cm. × 12 cm. being the equivalent for amateurs on the Continent.

CHANGE-BOX CAMERAS

In these, glass plates or cut films, usually twelve in number, were contained in a separate change-box which was attached to the camera and permitted the plates to be changed in daylight. It was derived from the plate changing bag, a contrivance put on the market for the first time (as far as is known) by the London firm T. OTTEWILL in 1854. By means of this bag, which had light-tight sleeves, the photographer could transfer the prepared paper into the dark-slide in the open air, and after exposure transfer it back again into its box via the bag. The change-box was somewhat on the lines of a film-pack cassette, and was usually fitted with an automatic counter to indicate the number of plates used. Each plate was contained in a separate sheath, and after exposure the plate was lifted into a soft leather bag attached to the top of the box, and then manipulated behind all the other plates, which meant that the next plate was now pushed into the focal plane. The prototype of this kind of change-box seems to have been one invented by J. A. FORREST for the paper process in 1854.[1] Such change-boxes were–like roller-slides–made in various sizes to fit the back of all standard cameras. The first for dry plates was patented by T. H. BLAIR in 1880, but it was only after the introduction of an improved type with a sleeve in 1884 that they began to find favour.

MAGAZINE CAMERAS

In magazine cameras a number of plates or cut films (usually twelve to forty) were stored in a magazine or chamber *inside* the camera itself, the plate being changed after each exposure by some kind of mechanism, differing in almost every camera model. Fig 53

The magazine camera has a much earlier prototype than one would expect from the date at which it began to establish itself. It has its origin in the calotype period and is the invention of MARCUS SPARLING, *c.* 1850 (see chapter 22).

In some magazine cameras the plates were contained in a grooved box attached to the top or bottom of the camera. They were dropped into the camera and returned to the box (or lifted into the camera and dropped into the box) by means of a rod with pincers, through a slit in the bottom or top of the camera, as the case may be. The next plate was then brought into position by sliding the magazine forward. The principle of this arrangement was again old–in this case an application of J. B. DANCER's arrangement for his improved stereoscopic camera, patented in September 1856.

In other magazine cameras, a dozen or more plates or cut films were stored in a chamber at the back of the apparatus. By various mechanisms, sometimes merely by shuttling the camera (hence this type was called 'shuttle magazine camera') the exposed plate was dropped to the bottom of the camera, and the next one pushed forward into the focal plane by a spring at the back of the magazine. Fig 54

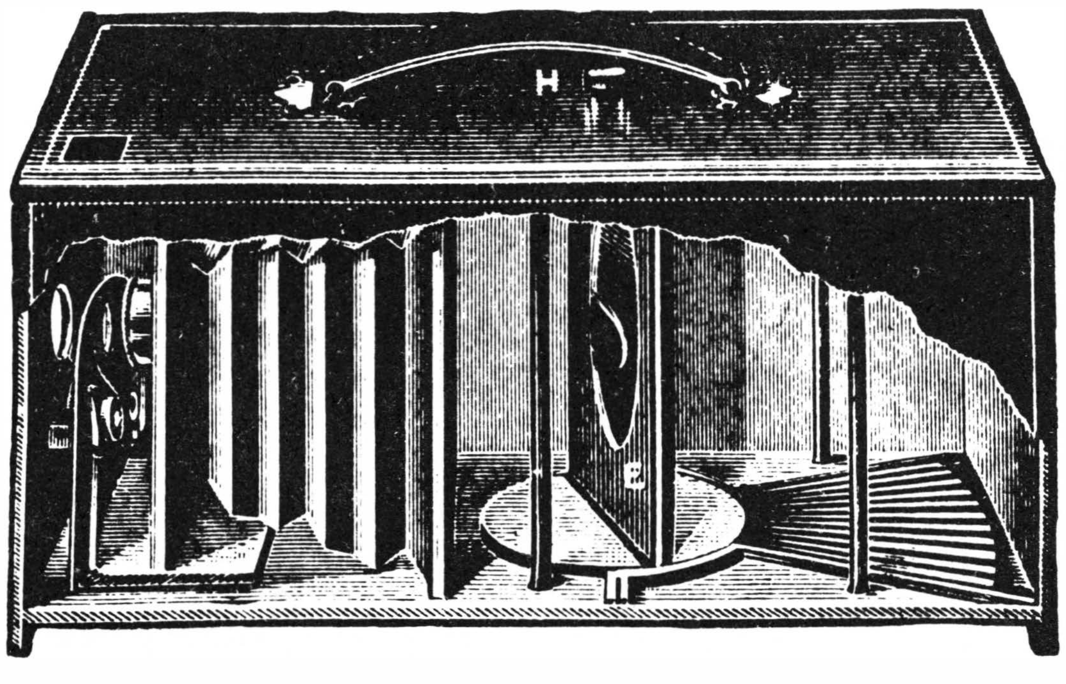
Particularly ingenious were the two magazine cameras for flexible gelatine film which ALFRED PUMPHREY patented in April and November 1881 respectively. In the first, separate pieces of film were securely held in frames fixed by one edge to an endless band passing over two rollers, similar to the arrangement in revolving stereoscopes. By turning a knob, a film was brought into a vertical position behind the lens, and secured by a stop; at the same time a counter indicated the number of the film in position. By a further turn of the knob the exposed piece of film was moved on, and the next frame came into place. Thus, after twenty-one years, was fulfilled Herschel's forecast of 'the possibility of taking a photograph, as it were, by a *snap shot*–of securing a picture in a tenth part of a second . . . a mechanism by which a prepared plate may be presented, focussed, impressed, displaced, numbered, secured in the dark, and replaced by another, within two or three-tenths of a second.'[2] Incidentally, it is in the above paragraph that the very apt term 'snap-shot' was coined.

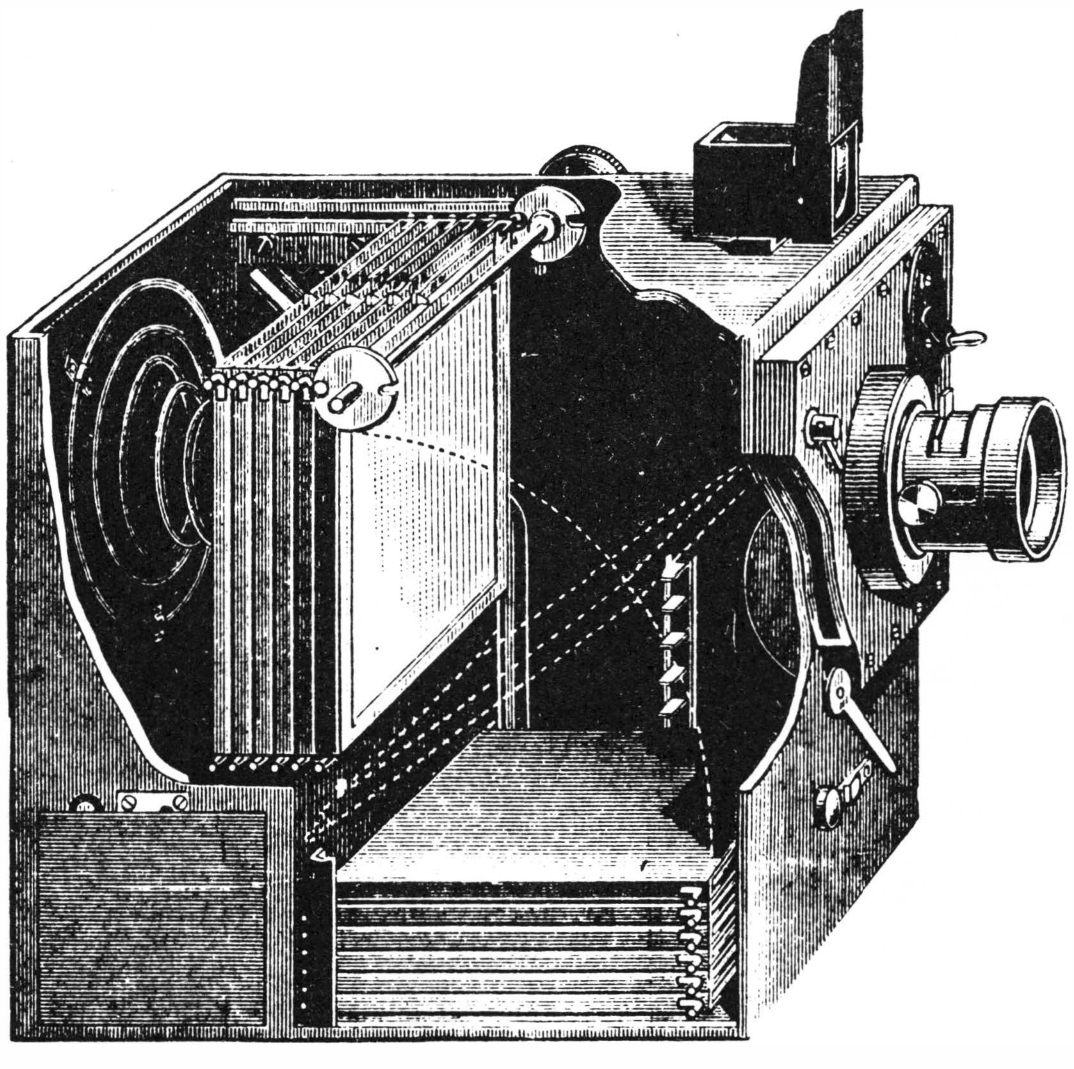
In 1882 Pumphrey's factory at Birmingham put into production his second magazine camera, the '100-fold Filmograph'. The entire apparatus, with 100 sheets of $3\frac{1}{4}$ in. × $4\frac{1}{4}$ in. film, weighed only $2\frac{1}{2}$ lb. Fig 55

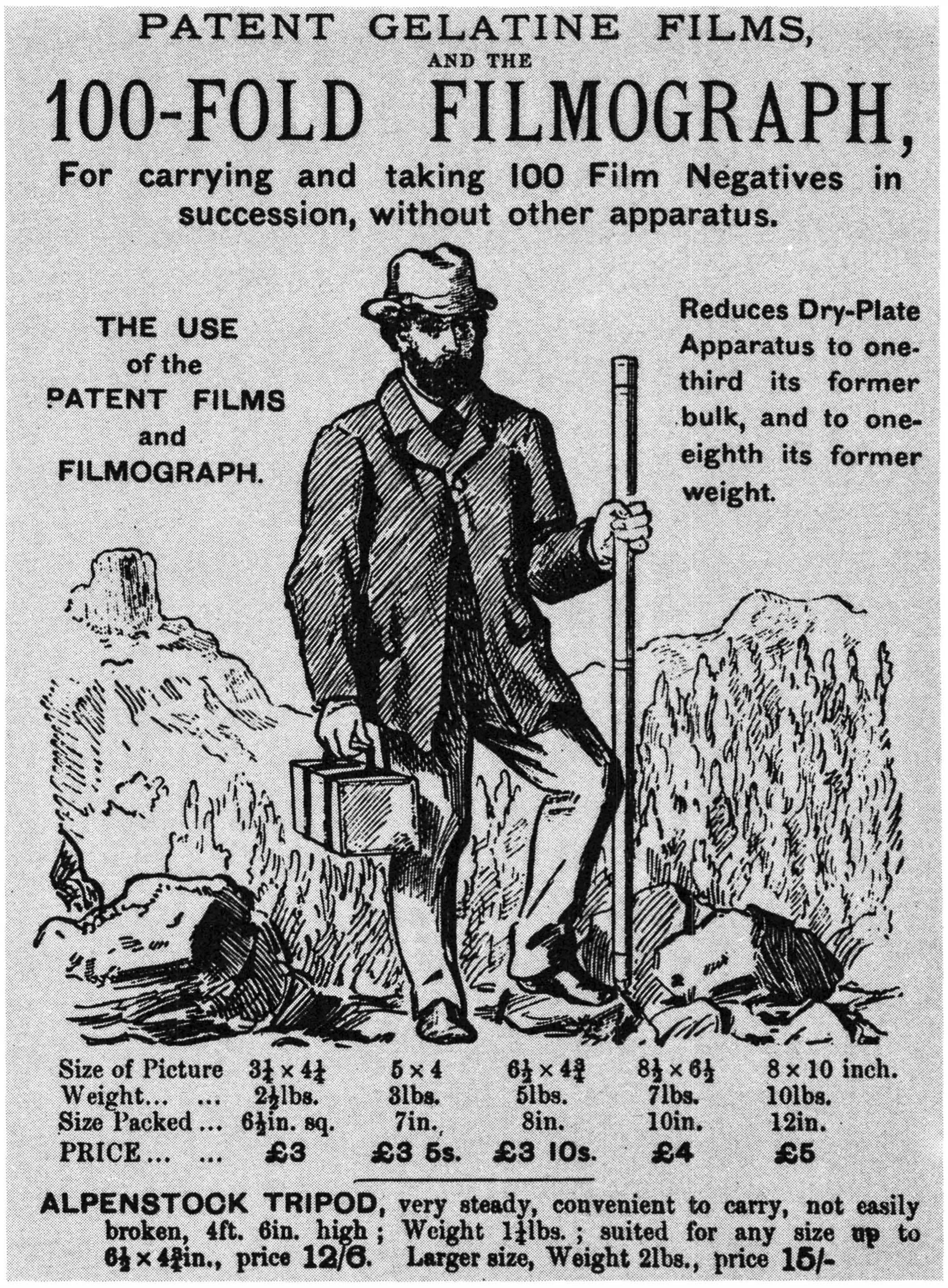
A magazine camera which enjoyed great popularity in England in the 1890s and early years of this century was J. F. CLARKE's 'Frena' (1892), introduced by the makers R. & J. Beck with the slogan 'Anyone who can ring an electric bell and turn a key can take pictures with this apparatus.' The 'Frena' was the first hand camera to expose a pack of celluloid cut films (forty in number, $3\frac{1}{4}$ in. × $4\frac{1}{4}$ in.) which were

Fig 53 (below) Marion & Co.'s 'Radial' magazine camera, 1890 (invented by G. Dickinson)

Fig 54 Magazine camera, c. 1885







PATENT GELATINE FILMS,
AND THE
100-FOLD FILMOGRAPH,
For carrying and taking 100 Film Negatives in succession, without other apparatus.

THE USE
of the
PATENT FILMS
and
FILMOGRAPH.

Reduces Dry-Plate Apparatus to one-third its former bulk, and to one-eighth its former weight.

Size of Picture	3¼ × 4¼	5 × 4	6½ × 4¾	8½ × 6½	8 × 10 inch.
Weight... ...	2½lbs.	3lbs.	5lbs.	7lbs.	10lbs.
Size Packed ...	6½in. sq.	7in.,	8in.	10in.	12in.
PRICE... ...	£3	£3 5s.	£3 10s.	£4	£5

ALPENSTOCK TRIPOD, very steady, convenient to carry, not easily broken, 4ft. 6in. high; Weight 1¼lbs.; suited for any size up to 6½ × 4¾in., price 12/6. Larger size, Weight 2lbs., price 15/-

Fig 55 Alfred Pumphrey's '100-fold Filmograph' magazine camera, 1882

notched to fit in grooves, and inserted in a holder like a pack of playing-cards. As with the Kodak, each exposure required only three manipulations by the operator: winding the shutter, pressing the button, and changing the film, which was done by turning a lever which simultaneously changed the number on the indicator.

ROLLER-SLIDES AND ROLL-FILM CAMERAS

These eventually superseded change-box and magazine cameras on account of their still greater simplicity of manipulation. The film is wound on two spools, and the action of winding on the exposed portion unwinds a fresh portion for the next exposure.

Originally the film was contained in a separate box–the roller-slide or roll-holder –which was made in many sizes for attachment to any standard plate camera. GEORGE EASTMAN and W. H. WALKER popularized the roller-slide when they introduced the mass-produced article in 1885, carrying negative paper for 24 exposures. In 1888 it was loaded with stripping film sufficient for 48 exposures, and in the following year with the new nitro-cellulose film for 24 or 48 exposures. But the origin of the roller-slide dates back to the year of Eastman's birth, 1854. Of the several similar contrivances put on the market after MELHUISH and SPENCER's (see chapter 14), mention should be made of C. J. BURNETT's (1859) and CAMILLE DE SILVY's (1867). LEON WARNERKE's roller-slide introduced in 1875 and containing a spool of stripping film for 100 exposures was as perfect a device as Walker's. Warnerke's was a very

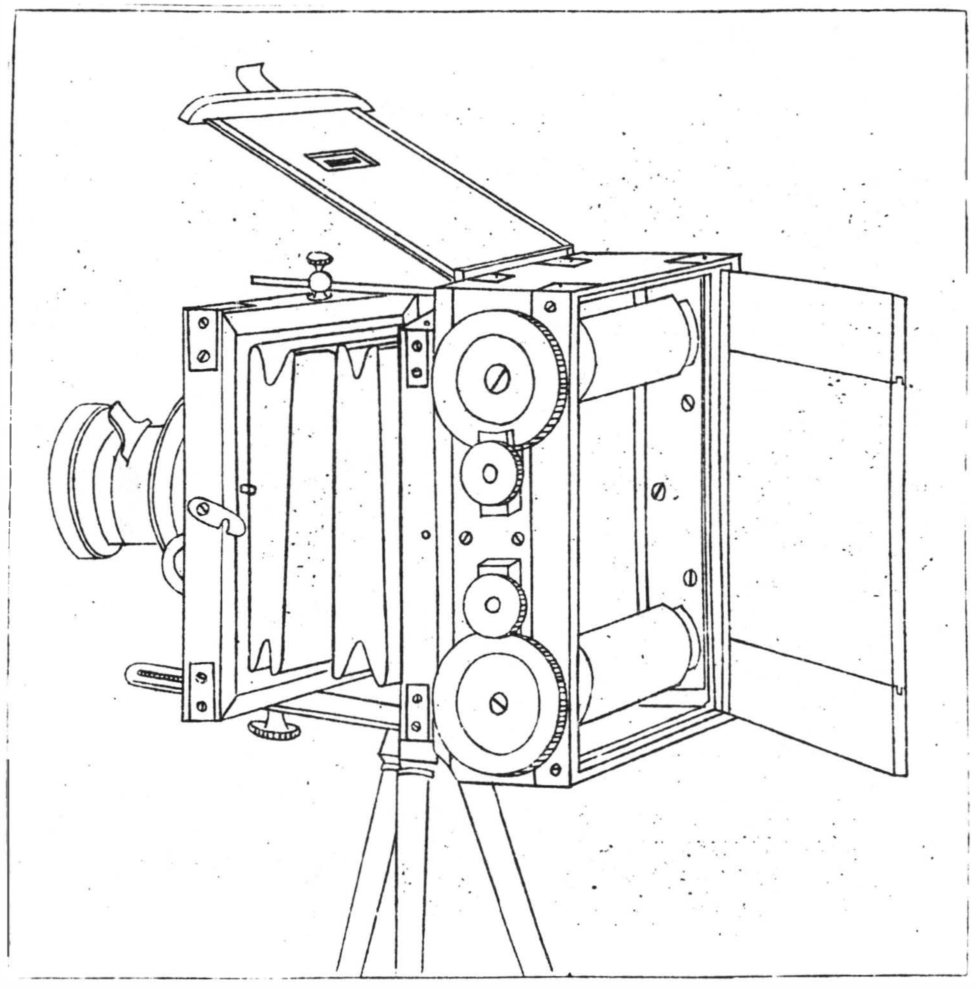


Fig 56 Leon Warnerke's camera and roller-slide, 1875

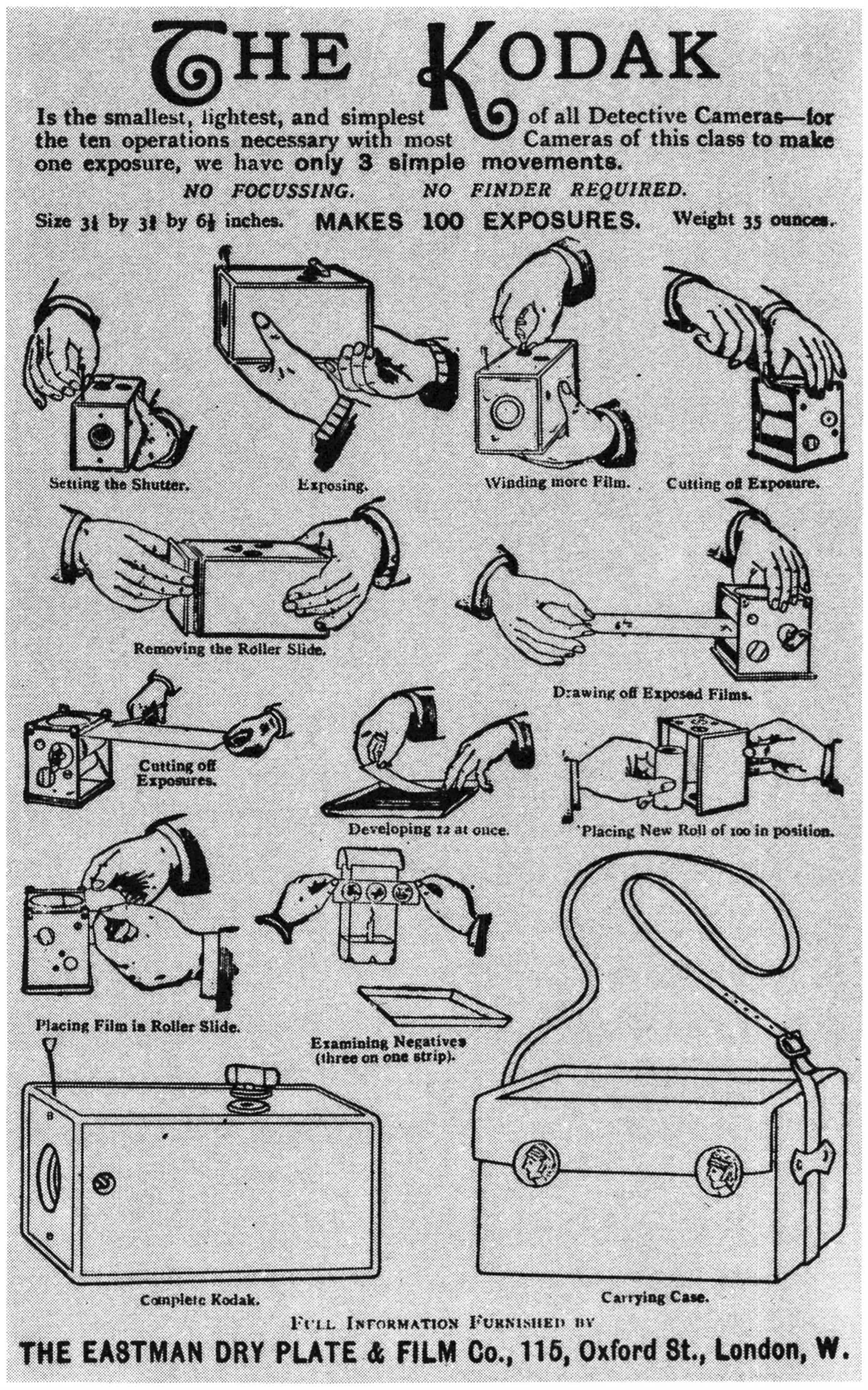
modern-looking folding camera, which extended on a monorail.[3] It was the first apparatus taking such a large number of pictures without reloading–thirteen years before the Kodak. Another feature retained in most modern roll-film cameras was the little (orange-coloured) window through which the number marked on the film could be seen.[4] Fig 56

In Warnerke's 1881 model the paper band, now reduced to forty exposures, was perforated near the edge with a series of small holes corresponding with the length of each picture. On account of the very sensitive gelatine-emulsion negative paper now used, the orange window had been replaced by a tiny alarm bell which rang the moment the paper had been wound on to the right position for the exposure. At that moment the perforation allowed a metal stud to come into contact with a small battery inside the roller-slide, which produced the electric current for the bell. The idea was later incorporated in the Eastman/Walker roller-slide.

Why, one may ask, did Warnerke's, or for that matter any of the inventions before Eastman/Walker's roll-holder, fail to establish themselves, if they were good? The answer is simple: it was only the new type of snapshooting amateur who created a demand for such devices, and only their large numbers which made mass-production feasible and brought down the price, at the same time creating a demand for developing and printing (D. & P.) firms, which took over the processing of these awkward long bands of negative material.

The invention which gave the greatest stimulus to amateur photography was the Kodak,[5] introduced by George Eastman in August 1888. It reduced the ten or more operations hitherto necessary to make an exposure to three, reduced the weight and bulk in the same proportion, yet permitted the taking of one hundred pictures without reloading. A small simple hand camera measuring only 6½ in. × 3½ in. × 3½ in. and weighing 2 lb. 3 oz., the Kodak was the first apparatus incorporating a roll-film arrangement. Fitted with a rectilinear fixed-focus lens giving sharp definition of everything beyond 8 ft, and having only one speed and a fixed stop, the apparatus was the last word in simplicity; 100 circular pictures 2½ in. in diameter could be taken in succession on stripping film, and the price of 25 dollars (then 5 guineas), including a leather case, was reasonable.[6] Fig 57

> Today [wrote George Eastman in the instruction booklet] photography has been reduced to a cycle of three simple operations. 1. Pull the String. 2. Turn the Key.



THE KODAK

Is the smallest, lightest, and simplest of all Detective Cameras—for the ten operations necessary with most Cameras of this class to make one exposure, we have only 3 simple movements.

NO FOCUSSING. *NO FINDER REQUIRED.*

Size 3¼ by 3¾ by 6½ inches. MAKES 100 EXPOSURES. Weight 35 ounces.

Setting the Shutter.
Exposing.
Winding more Film.
Cutting off Exposure.
Removing the Roller Slide.
Drawing off Exposed Films.
Cutting off Exposures.
Developing 12 at once.
Placing New Roll of 100 in position.
Placing Film in Roller Slide.
Examining Negatives (three on one strip).
Complete Kodak.
Carrying Case.

Full Information Furnished by

THE EASTMAN DRY PLATE & FILM Co., 115, Oxford St., London, W.

Fig 57 Advertisement of the first Kodak camera, 1888

> 3. Press the Button. This is the essence of photography and the greatest improvement of them all; for where the practice of the art was formerly confined to those who could give it study and time and room, it is now feasible for *every body.* The Kodak Camera Renders Possible the Kodak System, whereby the mere mechanical act of taking the picture, which anybody can perform, is divorced from all the chemical manipulations of preparing and finishing pictures which only experts can perform. Hence it is now easy for any person of ordinary intelligence to learn to take good photographs *in ten minutes.* Not simply to take one picture as an experiment, but to repeat it over and over again with such accuracy as to average over eighty-five per cent. good pictures from the start.

The Kodak's enormous appeal to the amateur[7] lay in Eastman's processing service; the camera could be sent to the factory for the developing and printing (or enlarging) of the film, after which it was returned with a hundred mounted prints (if all were successful), and loaded with a new film, for a service charge of ten dollars. Thus Eastman's slogan, 'You press the button, we do the rest' was put into practice. Eastman's persuasive statement that 'A collection of these pictures may be made to furnish a pictorial history of life as it is lived by the owner, that will grow more valuable every day that passes' was a brilliant application of mass psychology to business. This was and is all that the average camera user asks of photography, and thus modern photography was launched.

The Kodak was a veritable Pandora's box: the push-button method let loose many of the evils from which photography is suffering today. On the other hand, it has undoubtedly enriched the lives of millions of ordinary men and women.

Naturally, other manufacturers tried to profit from the popularity of the Kodak (which for many years remained the only roll-film camera on the market, owing to Eastman's virtual monopoly of roll-film) by producing still smaller plate or cut-film pocket cameras, but in spite of all their efforts, for at least two decades if not three, a hand camera of whatever make was popularly called a 'Kodak'.

REFLEX CAMERAS

The single- and twin-lens reflex cameras are classed as a separate group because–although they were made variously with change-box, magazine, or roll-film attachments–they are basically of a different construction. As every photographer knows, reflex cameras incorporate a mirror fixed at an angle of 45° to the axis of the lens. It reflects the image on to a ground glass in the top of the camera, allowing observation of the scene up to the moment of taking the picture, and obviating the need for a black focusing-cloth.

The first to apply this centuries-old *camera obscura* principle to photographic purposes was THOMAS SUTTON, who patented a reflex instrument in August 1861. When making the exposure, the mirror was turned up by a handle. The first reflex camera in which the mirror was *automatically* displaced during the exposure by being connected with the roller-blind shutter seems to have been S. D. MCKELLEN'S, patented in May 1888. As far as we can ascertain, neither Sutton's nor McKellen's cameras ever went into production. One of the first single-lens reflex cameras produced was C. R. Smith's, patented in Britain, France, and the United States in 1884. It was a hand camera for $6\frac{1}{2}$ in.× $4\frac{1}{4}$ in. plates, manufactured by E. W. Smith & Co., New York.

One of the best early single-lens cameras, and certainly the most rapid, was the 'Cambier Bolton' introduced in 1898 by W. Watson, London. This camera, based on the ideas of the photographer F. W. Mills, was intended for the serious photographer, being provided with a double extension and Rapid Rectilinear lens, and a Thornton Pickard focal plane shutter which gave speeds from $\frac{1}{20}$ to $\frac{1}{1000}$ second. Exposures were made automatically by pressing a button which raised the mirror and released the shutter. The 'Holostigmat' lens, series 1a, a symmetrical anastigmat doublet, with which the camera was fitted from 1906 on, made it the fastest on the market, for this anastigmat gave perfect definition at the full aperture of F. 4·6.

R. & J. BECK in February 1880 constructed the first twin-lens reflex camera, for the meteorologist G. M. Whipple, Superintendent of Kew Observatory. Both lenses were focused simultaneously by turning one knob. The camera was made to take $3\frac{1}{4}$ in. × $4\frac{1}{4}$ in. plates, and except for the roller-blind shutter attached to the taking lens, it does not appear to have differed in any essential point from modern twin-lens reflex cameras.

Several twin-lens reflex cameras followed Beck's, including the 'Excel Detective' made by ARMIDE LE DOCTE of Brussels (1890), the 'Artist's camera' of the London Stereoscopic Co. (1891), and Ross & Co.'s 'Divided' (1891) which was the most advanced of all. Three models were made, for taking a 48-exposure Eastman roll-holder, three double darkslides or a change-box containing twelve plates. The dimensions of the smallest size, made for $3\frac{1}{4}$ in. × $3\frac{1}{4}$ in. negatives, were only 6 in. × $4\frac{1}{2}$ in. × $7\frac{1}{4}$ in., and compare very favourably with the modern 'Rolleiflex'. Exposures were made by means of a roller-blind shutter fitted in front of the taking lens. Pl 220

POCKET CAMERAS

Many of the cameras advertised as 'pocket' cameras were in fact hand cameras. 'The so-called pocket cameras are a delusion, a mockery, and a snare', complained a photographer in 1882. 'A quarter-plate camera with stand and half-a-dozen plates in the dark slide weighs some 7 or 8 lbs., and the camera is so bulky that it cannot by any possibility be carried in an ordinary pocket. It is a misnomer altogether as at present constructed.'

Fig 58 The first real pocket cameras were Marion & Co.'s metal miniature camera of 1884 and the 'Tom Thumb' made by Ford of New York about 1890. The external measurements of the latter were 3½ in. × 3½ in. × 2½ in. and it weighed 7¾ oz. Like the Kodak, it had a fixed-focus lens, but, unlike the Kodak, it was made for plates, each in a separate plate-holder. The picture area was 2½ in. square.

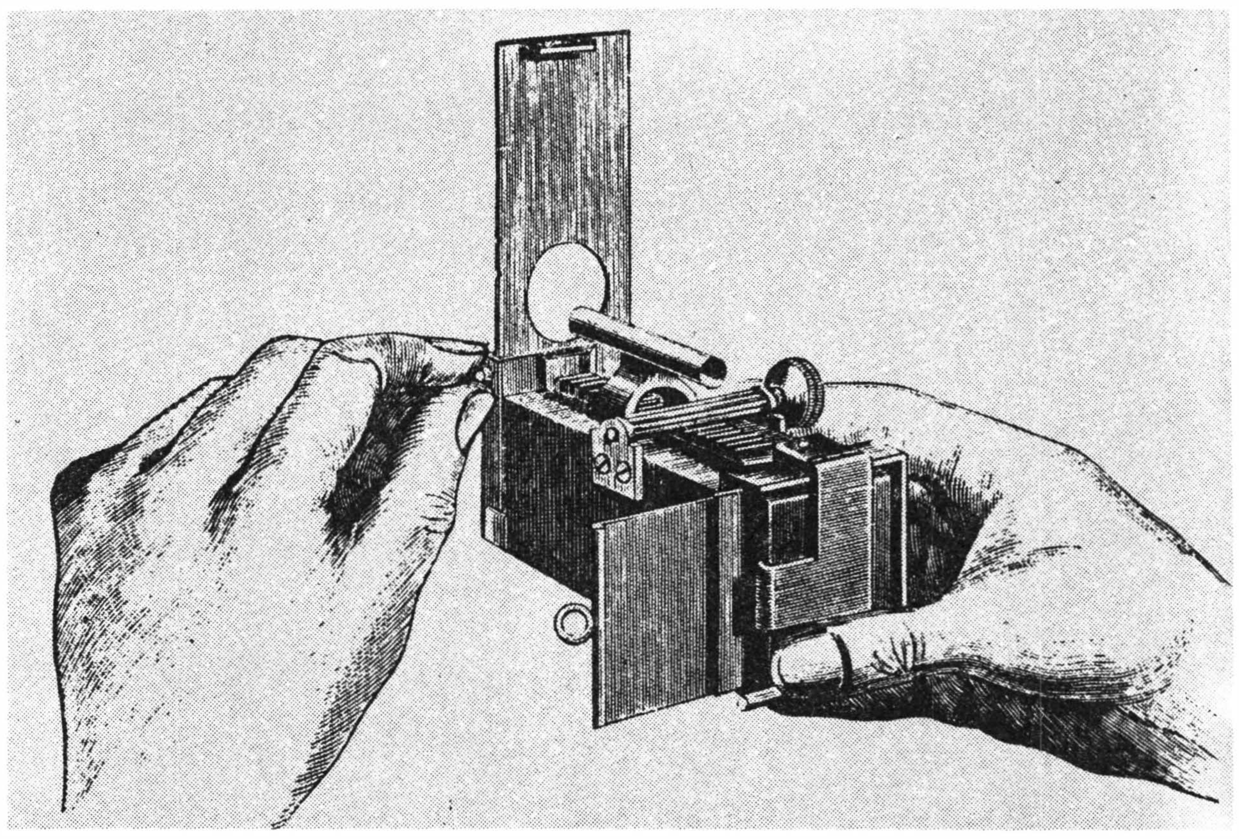


Fig 58 Marion & Co.'s metal miniature camera, 1884

In 1895 Eastman followed up his box-form and folding Kodaks with a still smaller, lighter, and cheaper pocket model, measuring only 2¼ in. × 2⅞ in. × 3⅞ in., taking a dozen 1½ in. × 2 in. pictures. The price was 1 guinea. Designed by FRANK A. BROWNELL, this camera was the prototype of the 'Brownie' class. It incorporated an important new feature–the daylight-loading roll-film spool, which had been invented by PARKER B. CODY of the Blair Camera Co. in 1894. The sensitive film was tightly enclosed in a roll of black paper (as it is today); the black paper was marked in white ink with the film numbers, which could be read through a small window of red celluloid in the back of the camera. Before 1891, the Eastman roll-film holders and Kodaks had to be loaded in the darkroom. From 1891 the celluloid film had attached to it at both ends a few inches of black paper (subsequently black cloth)–a system employed by Professor E. J. Marey of Paris from 1887–which allowed films to be changed in the subdued light of an ordinary room. An automatic lock and counter controlled the amount of film wound on and indicated the number of exposures that had been made. In other respects, too, this camera pointed the way to modern construction: it was made of aluminium (weight only 7 oz.) and the shutter was set and released by one button. Good enlargements up to 12 in. × 15 in. were claimed to be possible from the negatives. Three years later Eastman effected a further improvement in compactness–the Folding Pocket Kodak measuring 1⅝ in. × 3½ in. × 6¾ in., taking twelve exposures 2¼ in. × 3¼ in. It was a collapsible camera with bellows, the lens-board being held rigid by struts. Folding pocket cameras were, however, not a novelty; several makes for dry plates had been on the market since 1881, such as J. F. Shew & Co.'s 'Eclipse', J. Lancaster & Son's 'Le Merveilleux' and Marion & Co.'s 'Academy'.

'DETECTIVE' CAMERAS

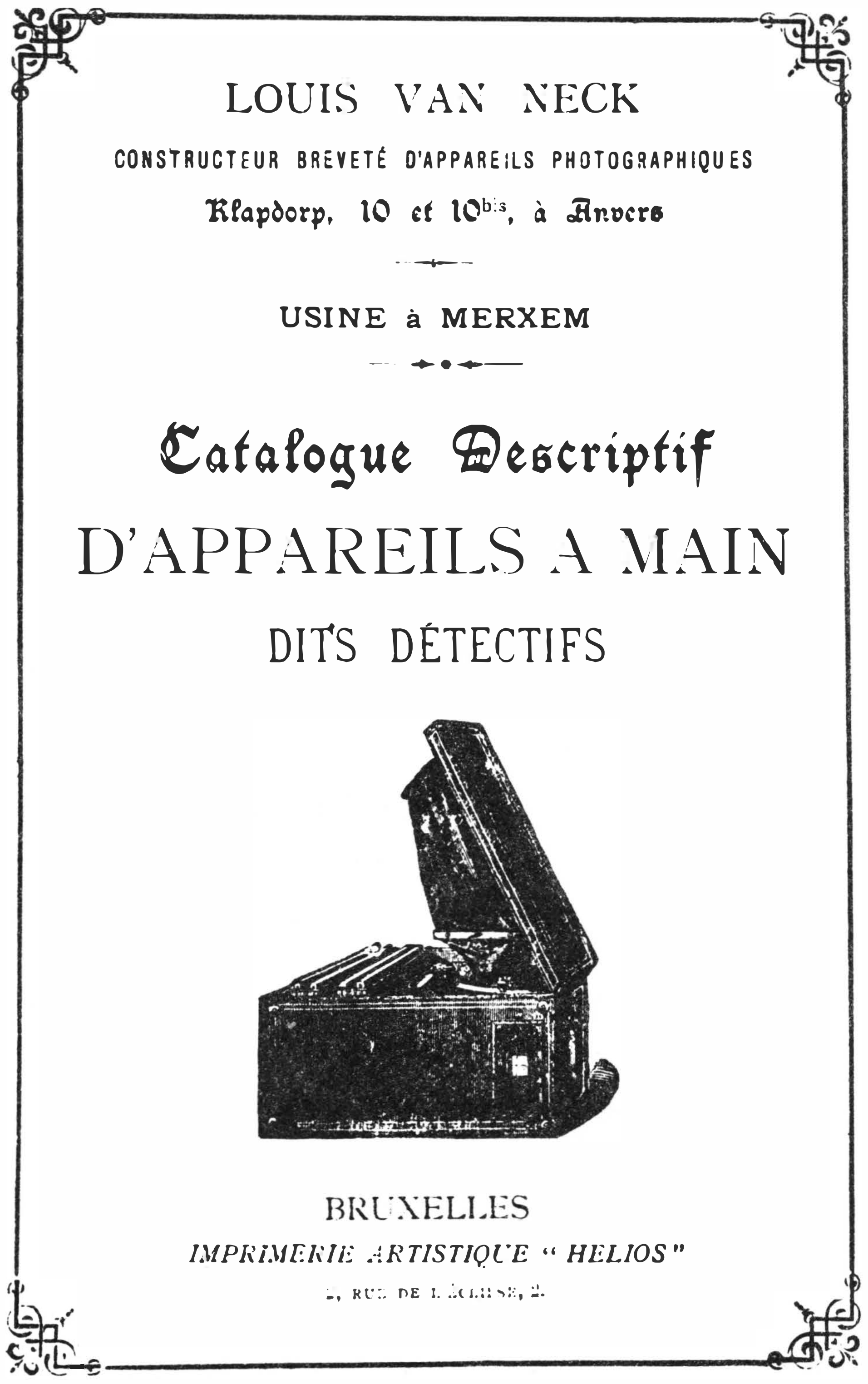
The fashion in the 1880s and 1890s of disguising almost any object as something else flourished nowhere better than in the so-called 'detective' cameras. The term was originally introduced by THOMAS BOLAS in January 1881 for two disguised magazine hand cameras which he designed for the police to take snapshots of suspected characters without their knowledge. One looked like a wooden box, the other was in the form of a book. The idea immediately caught on, and several makers introduced cameras masquerading as parcels, picnic baskets, Gladstone bags, and handbags. These were usually quarter-plate or 5 in. × 4 in. magazine cameras in the 5 to 10 guinea range. Soon, however, a craze started for detective cameras of quite a different kind, 'cameras that could be carried by a lady without attracting attention'. These were in the form of opera-glasses, field-glasses, books, watches, and purses. For men, they were in the form of revolvers, guns, or concealed in walking-sticks, hats, cravats, and beneath the waistcoat. Most of these were hardly better than toys. They were cheap, being fitted with poor lenses, and the picture was far too small to be of any use. Like their forerunners – the eighteenth-century camera obscuras disguised in walking-sticks and in book form – they cannot be regarded as proper equipment.

Fig 59

Fig 60

Pls 221–226

One of the earliest and most popular of detective cameras was the waistcoat camera invented by ROBERT D. GRAY of New York in 1885 and patented in the United States and Great Britain on 27 July 1886. It was manufactured by C. P. Stirn, New York. The flat, circular metal instrument, $5\frac{3}{4}$ in. in diameter, was worn beneath the waistcoat with the fixed-focus lens protruding through one of the buttonholes. Six circular pictures each $1\frac{5}{8}$ in. in diameter were taken on a gelatine dry plate, which was rotated by a knob protruding through another buttonhole. The instantaneous exposures were made by pulling a string in the trouser pocket.



LOUIS VAN NECK
CONSTRUCTEUR BREVETÉ D'APPAREILS PHOTOGRAPHIQUES
Klapdorp, 10 et 10bis, à Anvers

USINE à MERXEM

Catalogue Descriptif
D'APPAREILS A MAIN
DITS DÉTECTIFS

BRUXELLES
IMPRIMERIE ARTISTIQUE "HELIOS"
2, RUE DE L'ÉGLISE, 2

Fig 59 Title-page of Van Neck's catalogue of hand cameras, c. 1892

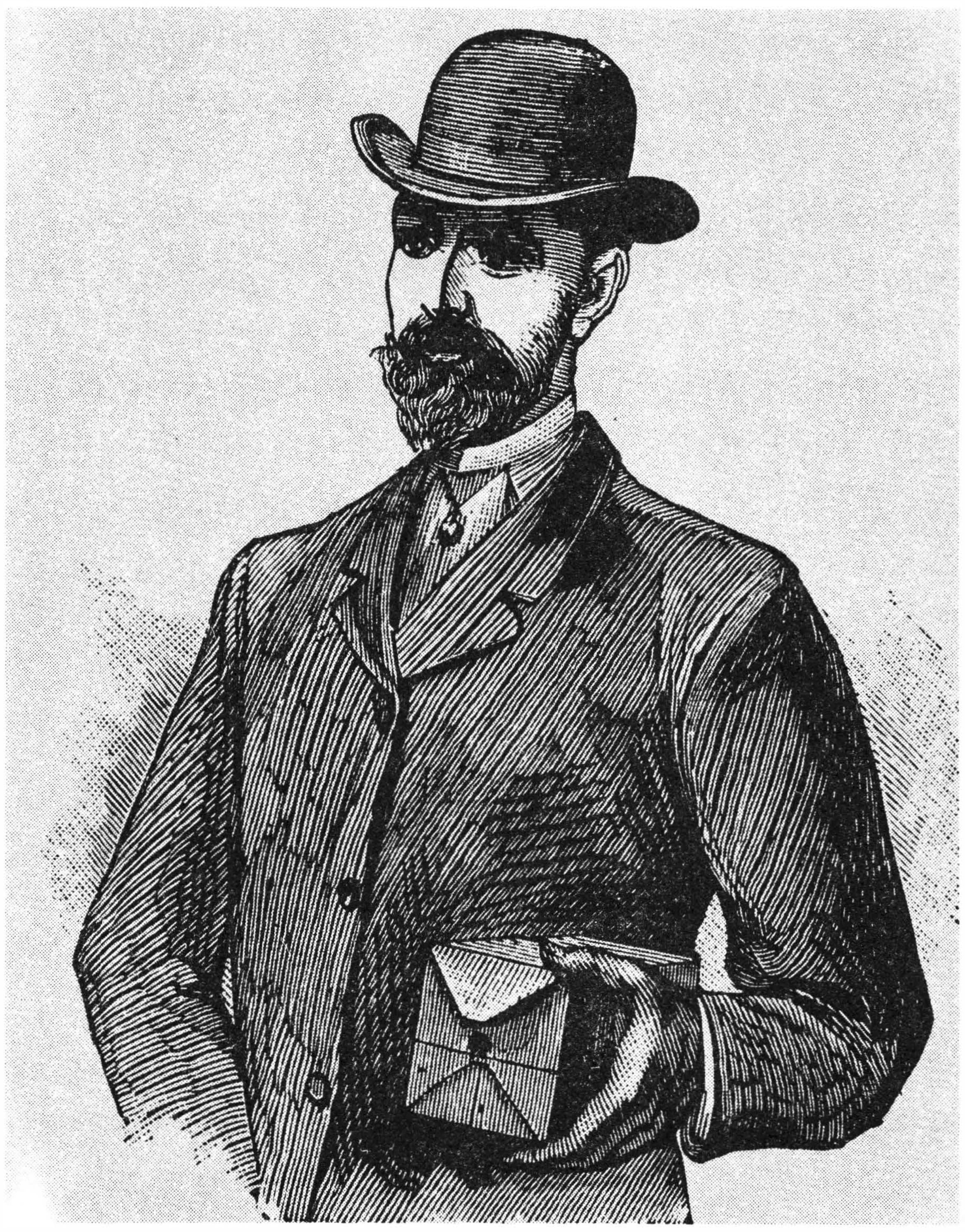


Fig 60 Enjalbert's detective camera in the form of a parcel, 1886

Pls 223, 224 In the cravat camera of E. BLOCH, Paris, 1890, the lens looked like a tie-pin. The six plates each 2·5 cm. × 2·5 cm. (1 in. square) were moved into position behind it by rotating the button. The shutter was released by pressing an air valve which was concealed in a waistcoat pocket. Bloch also invented a stereoscopic metal camera in Pl 226 the form of field-glasses, 'Le Physiographe', which was manufactured in France and patented in Britain on 1 October 1896. It contains two Rapid Rectilinear fixed-focus lenses in one eye-tube at right-angles to the eyepiece which is fitted with a view-finder. The other tube forms a magazine holding 12 glass plates $4\frac{3}{4}$ in. × 2 in. Each of the double pictures measures $2\frac{1}{4}$ in. × 2 in.

HERMAN CASLER's 'Presto' camera (1896) manufactured by E. B. Koopman, New York, looks rather like an alarm clock. This tiny camera made of metal takes four $1\frac{1}{4}$-in. square glass plates, or could be loaded with roll-film for 50 exposures. It has a fixed-focus lens with three diaphragms.

Pl 225 M. NIELL's 'Ticka' camera, patented on 14 October 1903 and introduced by Houghtons Ltd, London, three years later, looks like a watch. It takes 25 pictures on 16 mm. roll-film. The automatic counter is coupled with the key for winding the film on. Time and instantaneous exposures could be taken with the fixed-focus lens which is in the position of the winding knob of the 'watch'.

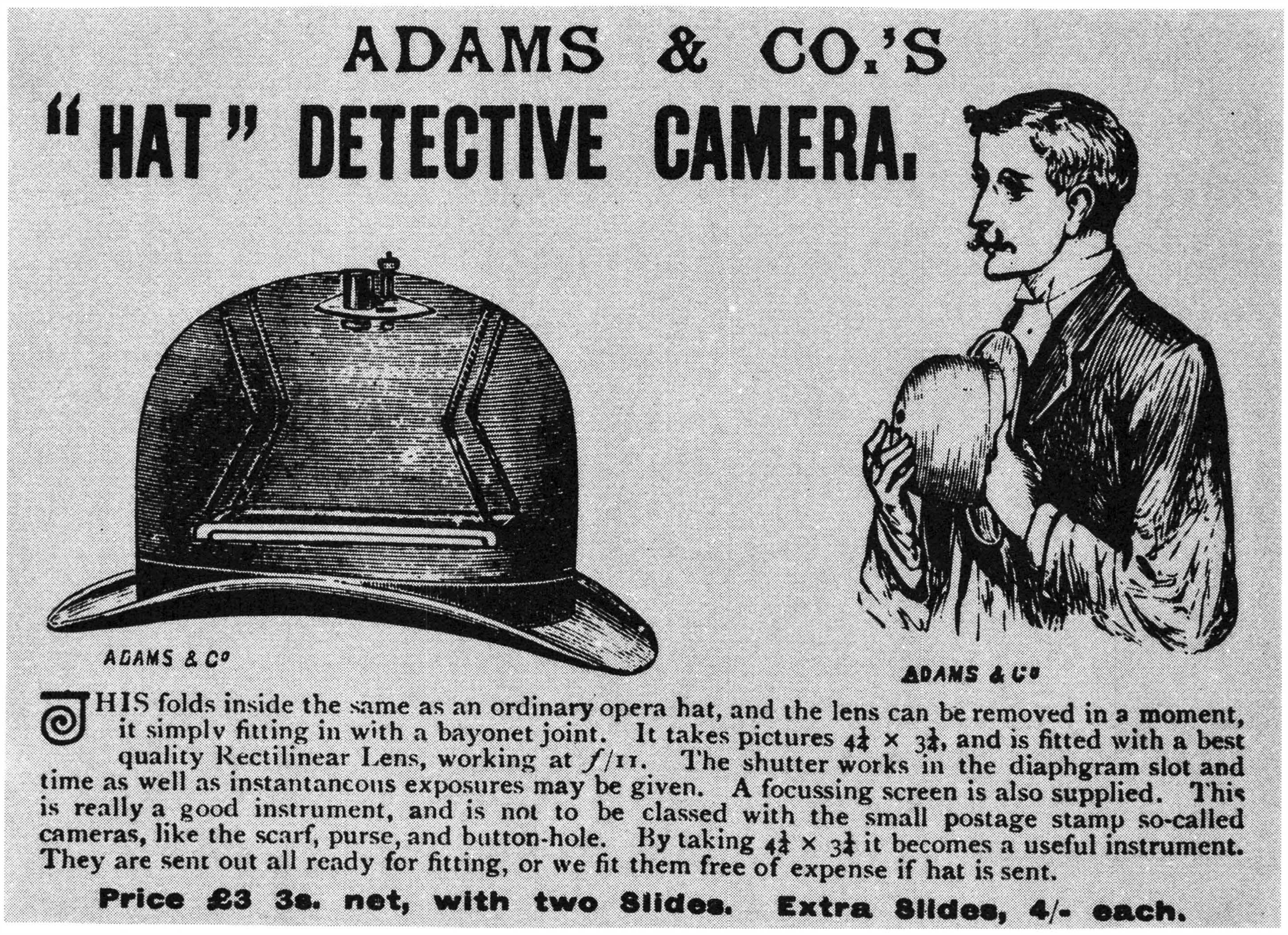
Pl 222 The walking-stick camera invented in 1891 was put on the market by A. Lehmann, Berlin, in 1903. The brass camera measuring $4\frac{1}{2}$ in. × $3\frac{1}{2}$ in. × $\frac{7}{8}$ in. screws on to the stick, forming its handle. The hollow stick acts as a film magazine for 12 film spools of 25 pictures, each measuring $\frac{3}{4}$ in. × 1 in., which were claimed to enlarge satisfactorily up to 4 in. × 5 in. The fixed-focus lens has a simple shutter, exposures being made by pulling a string.

In 1910 the 'Monocular' camera in the form of a small hand telescope or spy-glass was introduced in Paris. It had a 'Stylor' lens by H. Roussel, Paris, F. 4·5, focal length 2 in. There were three shutter speeds, $\frac{1}{25}$, $\frac{1}{50}$, $\frac{1}{80}$ second, and scale for 1 metre to infinity. The camera had a film-pack holder for twelve $1\frac{3}{4}$ in. × $2\frac{1}{4}$ in. pictures, which were taken at right-angles to the direction in which the apparatus is pointed, in order not to attract the subject's attention. Fourteen years later a similar camera was introduced by Zeiss Ikon, Germany, as the 'Ergo'.

The most amusing of these detective cameras was perhaps the photographic hat—the eccentric idea of a shy Englishman who explained that there were many views and buildings in London which he would like to take 'but dare not for fear of a juvenile audience'. He thought of overcoming the difficulty by fitting into that often abused article, the hat, a small camera, so tiny that it would only increase the hat's weight by 3 or 4 oz., and yet allow him to take pictures 'concealed from vulgar gaze'. He proposed operating the shutter which hid the small hole in the crown of the hat, by pulling a cord.[8] Vernon Heath vouched for the fact that this original suggestion was actually carried out, adding 'In one breast pocket of his coat he had his [sensitizing] bath and in another a developing bath fitted with yellow glass. And with such means he succeeded in obtaining pictures.'[9]

Nevertheless, the idea was forgotten, and the hat camera seemed a startling novelty when an amateur photographer J. DE NECK of Brussels reintroduced it in 1885. His apparatus incorporated a magazine for twelve plates $1\frac{3}{4}$ in. square. The lens was a Steinheil aplanat, with a focal length of $2\frac{1}{4}$ in. Other hat cameras were introduced by Fig 61 Luders of Görlitz (1885) and by Adams & Co. of London (1891).

By means of a camera hidden in his top hat, in which he had cut a hole for the lens, the English press photographer ARTHUR BARRETT succeeded in 1908 in taking Pl 227 secretly a number of very expressive close-ups of suffragette leaders in the dock at



ADAMS & CO.'S

"HAT" DETECTIVE CAMERA.

THIS folds inside the same as an ordinary opera hat, and the lens can be removed in a moment, it simply fitting in with a bayonet joint. It takes pictures 4¼ × 3¼, and is fitted with a best quality Rectilinear Lens, working at *f*/11. The shutter works in the diaphgram slot and time as well as instantaneous exposures may be given. A focussing screen is also supplied. This is really a good instrument, and is not to be classed with the small postage stamp so-called cameras, like the scarf, purse, and button-hole. By taking 4¼ × 3¼ it becomes a useful instrument. They are sent out all ready for fitting, or we fit them free of expense if hat is sent.

Price £3 3s. net, with two Slides. Extra Slides, 4/- each.

Fig 61 Adams & Co.'s hat camera, 1891

Bow Street Magistrate's Court, London, which caused a sensation since photography is forbidden in British law courts.

These detective cameras pointed the way towards the miniature camera, though the 'Leica', the first scientific precision instrument, did not arrive until 1924.

When the 'Demon' detective camera was advertised in 1893 some of the claims made for it seemed incredible, and were probably more in the realm of fantasy than reality, yet as everyone knows, the modern miniature camera does really perform such marvels.

In Daylight, Gaslight, Sunshine, Rain,
Each faithful Demon works the same:
And fills with life the album page
While Five Guinea Cameras groan with Rage.

No. 1 size, Price 5*s.* No. 2 size, Price 10*s.* 6*d.*

> The 'Demon' Camera defies detection, and can be secreted under the vest, in the watch pocket, or concealed in the glove. It is made entirely of metal, beautifully plated, and weighs under 3 oz. No movement is too rapid for it, the racehorse at greatest speed, the flight of birds, even the lightning flash itself. By merely pressing the trigger the photograph is taken; therefore any person can use it, no knowledge of photography being necessary, for, unlike other cameras, it requires no focussing no stand, no adjustment, no dark slides, yet hundreds of plates can be carried and exposed in rapid succession. The 'Demon' Camera can be used on the promenade, in Law Courts, churches, and railway carriages; also in Breach-of-Promise and Divorce cases; in fact, at all awkward moments, when least expected.

To go into the histories of the many cameras made for specialized purposes, such as panoramic cameras, stamp cameras, polyphoto and automatic-machine cameras, would go far beyond the scope of this book. The coin-operated photo-automat introduced by Carquero & Guillaumot at the Paris International Exhibition, 1889, was the forerunner of present-day photo-booths and worked on the same principle.

Enough has been said to show that the industry enjoyed the greatest boom it ever had. New apparatus appeared on the market almost every week, for the ranks of photographers also swelled from week to week. And the end was still unforeseeable.

SHUTTERS

Whereas before 1880 it had generally sufficed to use a lens cap, a metal flap fixed to the lens, or a similar contrivance, quick-acting shutters of variable speeds had to be employed in conjunction with the new fast negative material and small camera sizes. Only in conjunction with these small cameras, and especially binocular cameras, had shutters been necessary during the collodion period. A mechanical shutter consisting of a revolving metal disk with an opening in it, and set by a spiral spring, was introduced by **ADOLPHE BERTSCH** of Paris in 1852. **J. B. DANCER** patented an improved version in 1856 with three apertures of different sizes acting as stops. In the 1880s and 1890s ingenious shutters were constructed in the form of metal segments or revolving disks set by springs and released by a pneumatic bulb, pneumatic guillotine shutters, and roller-blind shutters. They were all fixed in front of the lens, and gave variable speeds from 1 to $\frac{1}{100}$ second according to the degree of pneumatic pressure or spring tension. In hand cameras, the unwieldy drop and flap shutters were soon superseded by diaphragm or sector shutters incorporated in the lens–usually between the lens combinations. The Compur shutter devised by the Munich firm Friedrich Deckel in 1912 was a development of the same firm's earlier Compound shutter (1902). It is today universally fitted to good-quality hand cameras permitting exposures of down to $\frac{1}{500}$ second.

The focal-plane shutter, which is incorporated in all modern high-speed cameras, is a behind-the-lens shutter. The origin of this shutter is often erroneously attributed to the German photographer Ottomar Anschütz, because he included it in his camera patent of 1888, and C. P. Goerz subsequently fitted the popular Goerz/Anschütz press camera (see chapter 36) with such a shutter. But the focal-plane shutter with variable slit goes back to 1861 and is the invention of **WILLIAM ENGLAND**. England used it for his instantaneous street views with tannin dry plates, and he described its mechanism to the Photographic Society of London in April 1862.[10] Seventeen years later B. J. Edwards reintroduced the focal-plane shutter as the most suitable for fast gelatine plates, demonstrating it before the South London Photographic Society in November 1879.[11]

EXPOSURE METERS

In the collodion period exposures were still measured in minutes; they could be judged by experience inasmuch as each photographer employed, and indeed made, his own sensitive coating year in year out. The fact that in the gelatine period exposures had fallen to fractions of a second would probably not in itself have caused any problems, since the vast majority of amateur cameras were fitted with very simple shutters with three or four speeds, which were set according to the weather, time of day, and type of subject–very much as they are today. No, the difficulty that worried the serious photographer was the impossibility of knowing the speed of the negative because there existed no standardization amongst manufacturers. Plates and films were not marked with speed numbers, and great variations existed between different makes, and even between production batches of the same manufacturer.

DR FERDINAND HURTER, a Swiss chemist working in England from 1867 on, and his colleague **VERO CHARLES DRIFFIELD** were also amateur photographers, and tried to solve the problem of speed rating. Having first devised an actinograph–a kind of slide-rule calculator based on certain known factors–eventually in 1888 they found a method of determining the sensitivity of a photographic plate by exposing it to a series of lights of known intensities and measuring the densities obtained on development (gamma curve). Their researches based on numerous charts they had worked out were published in 1890,[12] and laid the foundation of photo-sensitometry.

On the Continent another system introduced in 1894 by JULIUS SCHEINER, professor of astro-physics in Berlin, and elaborated by Eder four years later, established itself until replaced about 1935 by the DIN scale (Deutsche Industrie Norm), and in the U.S.A. by the ASA (American Standards Association) scale. In the Scheiner system a rotatable disk was used, the numbered segments of which were graduated from light to dark in a certain ratio. After one second's exposure by a standard candle flame at a distance of 1 metre, the last number which was legible on the negative when placed on white paper indicated the speed of that negative material.

Far too scientific and complicated for use by the photographer himself, these speed-rating systems were used by manufacturers, who marked the packets of plates and films according to H. & D. or Scheiner speed numbers, or sometimes both.

For the photographers themselves the simplest form of exposure meter was the exposure table of the kind first devised by D. W. Seager at the beginning of the daguerreotype period. Others were exposure calculators based on Hurter and Driffield's actinograph. A third group are the chemical exposure meters, in which a strip of silver chloride paper is darkened. In ALFRED WATKINS's 'Standard' exposure meter patented on 27 January 1890 and manufactured by R. Field & Co. of Birmingham, the light intensity was measured by timing the number of seconds needed to darken the silver chloride test paper to a given standard tint. The instrument, in the form of a tube, carried a tiny roll of paper inside the lid, sufficient for several hundred readings. The seconds were measured by swinging the other lid on a chain attached to it, like a pendulum, each double swing lasting one second. Once the light intensity was established, the exposure time could be calculated by means of rotatable rings fixed around the brass cylinder of the tube when set for plate speed, diaphragm used and actinometer time. DR SCOTT's exposure calculator patented on 4 October 1892 and made by the Britannia Works Co. consisted of five concentric rotatable aluminium rings marked with various data from which the exposure could be calculated on the principle of the slide-rule. Favourites with amateurs up to the mid-1920s were Alfred Watkins's 'B' meter, patented on 22 December 1895, and C. WYNNE's 'Infallible' exposure meter (1905). Both instruments were in the form of a watch, and recorded the strength of illumination on a strip of silver chloride paper; after this the 'watch' was set for the speed rating assigned to the various makes of plates and films on a special speed card supplied with the instrument, the actinometer time and diaphragm number, and then the exposure time could be read off.

Lastly we must mention the optical or visual exposure meters in which the object to be photographed is observed through an eyepiece, usually containing a blue glass with numbered gradations of tone from light to dark. From the last still visible number the exposure can be read off when the instrument has been set for the other known factors. The first of the optical exposure meters was made by C. P. GOERZ and introduced with the Goerz/Anschütz press camera in 1888. Another well-known make was HEYDE's 'Actino-photometer', 1905. The best-known one before the Second World War was also of German design, the 'Bewi' manufactured in Munich. Despite exposure meters based on selenite photo-electric cells, of which the first was the American Weston meter, in 1932, optical meters are still necessary in architectural photography, being more reliable for long exposure readings in dark interiors.

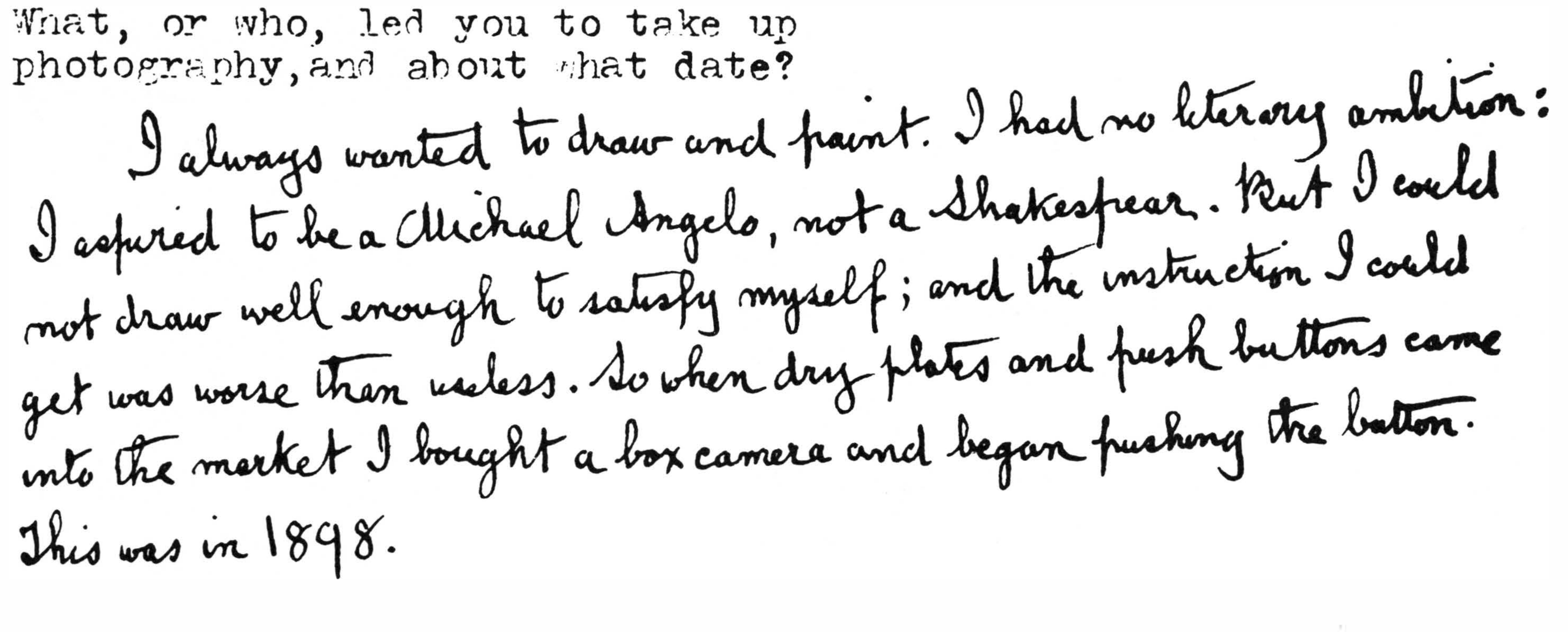
32 *Push-button photography*

The year 1880 constitutes a turning-point in the evolution of photography without parallel in its entire history. Gelatine emulsion effected revolutionary changes in every sphere of photography. Fast plates (and soon roll-films) in conjunction with hand and pocket cameras opened the door to thousands of amateurs who had hitherto been deterred from learning to make pictures. Formerly the photographer needed a darkroom and had to be thoroughly acquainted with the rules of focusing, and the relation of lens apertures to light, spending weeks learning developing, fixing, printing, toning, and mounting, before he could show good results. In former times it was considered a heresy to use any preparation that was not made by the photographer himself. 'The modern photographer does not like any complicated manipulations', wrote Leon Warnerke.[1] 'He wants only to obtain a result as good as possible with the least possible trouble. . . . If any good genius should realize the photographic dream of the modern enthusiast, I think it will be a sort of snuffbox with a tiny handle, one revolution of which would produce at once a large photograph already finished, mounted, and framed!' So easy had photography become that everyone who tried could produce a result of some kind. All the novice had to do was to buy one of the new small cameras, have it loaded with a packet of plates or a film, push a button, and leave the developing, printing, or enlarging to one of the new developing and printing (D. & P.) firms, which relieved him of all trouble and ensured the best possible results.

Gone were the days of messing about in darkrooms, and with them vanished the spirit and the enthusiasm of the early pioneers, who felt impelled to make pictures, however difficult the task; gone was the spirit of discovery, of experimentation, the fascination of watching the picture slowly appear as if by magic in the developing bath. The ardent amateur gave way to the new machine man, content to follow manufacturers' instructions implicitly, and relying on camera and D. & P. firms to make the pictures for him. Advertising slogans such as 'No previous knowledge of photography is required. Anybody can take presentable pictures right from the start without even soiling the fingers', did much for the popularization–and subsequent decadence–of photography. Apart from a small group of serious amateurs who started the aesthetic movement in photography (see chapter 37), most of the new camera enthusiasts were entirely devoid of artistic training and feeling. For them, snapshooting was a pastime, and they frittered away plates and roll-films, for in their hands the camera became a mere toy and ceased to be a means of expression. The bad effect of the facility of taking a large number of photographs was foreseen from the start by the scientist Sir W. de W. Abney: 'Whatever little notions of art a person might have in his head would certainly be driven out of it, for the knowledge that he could take an almost unlimited number of pictures would lead him to expose a sheet on every possible occasion, and probably 99% of what he obtained would be thoroughly inartistic productions.'[2]

For the first time in its history, everything about photography was mass-produced, from the apparatus, plates, films, and paper, to the pictures themselves. Once manufacturers had discovered a goldmine in the millions of amateurs the world over, they exploited credulity by skilful advertising and salesmanship of superfluous gadgets which they claimed would give better results. During the last eighty years the photographic industry has become one of the largest and richest in the world, though the industry has so far done comparatively little to raise the standard of photography. Mass-production has made materials simple and cheap, and no pursuit is better adapted than photography to cultivate the powers of observation, but this cultivation demands attention and reflection. However simple the manipulation, there is no short cut to knowledge. Individual thought and care are as vital for the production of good photographs as for success in any other craft. The subjects within the range of the amateur photographer are so diverse and the aspects even of one subject so numerous, that the need for instruction assumes greater importance than ever, yet the main stress is laid on equipment and materials, and this has resulted in a deterioration of standards, instead of increasing the output of good photographs in proportion to the number of camera users.

Up to 1880, the growth of amateur photography had been very gradual. The first impetus undoubtedly came from the invention of collodion photography and from the showing of photographs at the Great Exhibition in 1851. Talbot's partial renunciation of his patent rights in July 1852, and still more the complete freeing of photography from the shackles of his patent at the end of 1854, marked the second stage. With the introduction of gelatine dry plates and hand cameras in the 1880s, photography as a popular pastime became a mass movement. For every amateur who had dabbled in photography in the old wet plate days, there were now thousands who, thanks to dry plates, roll-films, and cheap hand cameras, were enabled to pursue this fascinating hobby, and to their ranks recruits were coming every day. EMILE ZOLA took up push-button photography shortly before his exile in England (1898), using a 6 cm. × 9 cm. camera. Later he bought a Kodak panoramic camera with which he took views of the Seine and the Auvergne. A keen amateur, Zola tried his hand at everything–portraits of his family and friends, still-life and architectural subjects.[3] GEORGE BERNARD SHAW admitted to the authors that his well-known comparison–'The photographer is like the cod, which lays a million eggs in order that



What, or who, led you to take up photography, and about what date?

I always wanted to draw and paint. I had no literary ambition: I aspired to be a Michael Angelo, not a Shakespear. But I could not draw well enough to satisfy myself; and the instruction I could get was worse than useless. So when dry plates and push buttons came into the market I bought a box camera and began pushing the button. This was in 1898.

Fig 62 G. B. Shaw's reason for taking up photography, 1949

Fig 62

one may be hatched'–was based on personal experience. When asked what led him to take up photography in 1898 he gave a typical Shavian reply: 'I always wanted to draw and paint. I had no literary ambition: I aspired to be a Michael Angelo, not a Shakespear [*sic*]. But I could not draw well enough to satisfy myself; and the instruction I could get was worse than useless. So when dry plates and push buttons came into the market I bought a box camera and began pushing the button. This was in 1898.'

The following figures taken from *The British Journal Photographic Almanacs* indicate the growth of the amateur movement.

PHOTOGRAPHIC SOCIETIES OR CAMERA CLUBS

Year	*Britain*	*United States*
1880	14	4
1885	40	20
1890	131	82
1895	250	109
1900*	256	99
1905	269	94
1910	354	*no longer listed*

**In this year there were only 23 Continental societies.*

Taking the British and U.S. Census figures we find that the increase in the numbers practising photography professionally was by no means proportionate to the growth of amateur photography.

GREAT BRITAIN

Year	*Men*	*Women*	*Total*
1851	50	1	51
1861	2675	204	2879
1871	4563	876	5439
1881	6008	1606	7614
1891	9119	3278	12397
1901	12335	4933	17268
1911	13205	5863	19068

UNITED STATES

Year	*Total*
1850	938
1860	3154
1870	7558
1880	9990
1890	20040
1900	27029
1910	31775

These figures do not, however, take account of the legion of itinerant photographers, or those who combined photography with a trade, nor, of course, the thousands of people who were employed by photographic firms in printing, mounting, retouching etc., who are listed in different categories.

We have not found any comparable figures for France, but it was stated in October 1892[4] that there were then about 30,000 professionals in France and over ten times that number of amateurs, giving the photographic industry a turnover of 60 to 70 million francs annually.

The rapid advance of photography in Germany between 1875 and 1895 is indicated by the following statistics.[5] In 1875 there were 2,506 exclusively photographic businesses giving employment to 4,674 people. Twenty years later 4,589 establishments employed 11,901 persons. Berlin naturally took the lead in this growth of photography. Breaking down the figures into male and female employees discloses a relatively greater increase in female labour there than in the rest of Germany.

	BERLIN			ALL GERMANY		
Year	*Men*	*Women*	*Total*	*Men*	*Women*	*Total*
1875	342	39	381	4229	445	4674
1882	514	89	603	5681	610	6291
1895	956	191	1147	10412	1489	11901

Owing to the increased number of photographers, competition became much keener and led to undercutting of charges, and a great depression in professional photography resulted. In earlier years a photographer with a moderately quiet business taking some twenty-five sitters a week could make a comfortable living for himself and his family; now he found that with about the same number of sitters per day as he then had per week, his net income was less than before.[6] Apart from professional competition, bitter complaints were made against amateurs who competed unfairly with professionals, and also lowered the standard. Only the top professionals were unaffected by this trend, but even for them the days of the boom which portrait photographers had enjoyed in the 1860s were over, never to return.

In 1905 it was estimated that there were four million amateur photographers in Great Britain, or, roughly speaking, one camera user in every ten of the population.[7] According to the Photographic Information Council there were 12 million British amateur photographers in 1964, spending a record sum of £69 million, and taking about 600 million photographs annually. One in three of these was in colour. (In 1954 the ratio was only one in 22.)

In the same year, 1964, one thousand million photographs were taken in West Germany. The ratio of colour to monochrome was the same as in Britain.

Jerome Ellison of *The Saturday Evening Post* recently compiled some interesting statistics of conditions in America. According to Ellison, amateur photographers in the States spend 400 million dollars a year on photographic materials and equipment, and own 34 million cameras–one camera user in every five of the population. Of these only a minority of about 300,000 adults and adolescents constitute the core of the non-professional photographic movement in about 6,000 camera clubs. About the same number of American high schools have camera clubs of their own.[8]

Another source[9] states that there were 35 million amateur and 55,000 professional photographers in the United States in 1954. Their total output was estimated at two thousand million pictures: what proportion of them deserved to be looked at by anyone except their makers must be left to the imagination.

33 *Photography by artificial light*

From the earliest days of photography attempts were made to take pictures by artificial light in order to shorten the exposure, and also to enable portraits to be taken on dull days and in the late afternoon. Though only fast gelatine plates made this possible for general adoption, the following pages give a summary of some notable early experiments with different forms of artificial light, which in progressive stages laid the groundwork for its application after 1880.

OXY-HYDROGEN LIGHT (LIMELIGHT)

L. L. B. IBBETSON of the Royal Polytechnic Institution, London, in the winter and spring of 1839–40 experimented with the oxy-hydrogen light–a jet of oxygen projected through a flame of hydrogen impinging on a disk or cylinder of lime, which became brilliantly incandescent. He succeeded in making in less than 5 minutes a daguerreotype of a piece of coral magnified 12½ times in a microscope–a subject which he said would have required 25 minutes by sunlight.[1]

One of J. F. GODDARD's most popular demonstrations of the daguerreotype process during his lectures at the Royal Institution and the Polytechnic Institution in March 1841 was to photograph a white bust by the oxy-hydrogen light with an exposure of 3 minutes. Two months later ANTOINE CLAUDET went a step farther by taking portraits from life by the oxy-hydrogen light in 15 seconds.[2] This, and other artificial light sources 'employed to take portraits at night' were patented by him on 18 Dec. 1841. These specimens were exhibited to the Royal Institution as a curiosity proving the relative speeds of Goddard's and Claudet's acceleration methods, rather than suggesting the application of limelight to portraiture. Claudet admitted that the light was too harsh, resulting in chalk-white faces.[3]

PYROTECHNIC LIGHT

JOHN MOULE's 'Photogen' (patented February 1857) was better suited to portrait photography. A pyrotechnic compound giving a brilliant bluish-white light (Bengal light) was burned in a big hexagonal lantern with glass sides. The time of combustion was about 15 seconds, during which the exposure was completed; the fumes were carried out of the window by a stove-pipe. A screen of blue glass sheltered the sitter from the dazzling light and softened the effect. The pyrotechnic compound was cheap (about 2*d.* per exposure), and Moule's offer to the profession to take a specimen portrait for 5*s.* so that they might see the result before paying £5 10*s.* for the apparatus proved his confidence, and portraiture at night became for a while a novel attraction. At the Photographic Society's exhibition in February 1858 the inventor showed five ambrotypes 'taken at night by artificial light'. 'Hideous portraits, ghastly and gravelike' commented a critic, but this may have been a prejudiced opinion, for during the winter of 1860–1 no fewer than 30,000 portraits were taken by the light of the Photogen, 'The Special Wonder of the Age–the Rival of the Sun'. One photographer claimed to have taken more than sixty portraits in one evening.[4] On dull days Moule used to invite clients to return in the evening so that he could photograph them by the light of the Photogen.

MAGNESIUM LIGHT

In 1859 PROFESSOR ROBERT WILHELM BUNSEN of Heidelberg and (SIR) HENRY ROSCOE of Manchester, for several years collaborators in photochemical researches, reported to the Royal Society on the extreme brightness and actinic qualities of burning magnesium wire and its value as a source of light for photography.[5] Their paper attracted the attention of EDWARD SONSTADT of Manchester, who set to work to produce the metal in a marketable form. He took out patents for methods of manufacture in 1862 and 1863 when he founded the Magnesium Metal Company in Salford. He presented one of the first lumps of the purified metal to Faraday at the Royal Institution, where the element had been discovered by SIR HUMPHRY DAVY in 1808. Within a year the company was able to produce thin magnesium wire at a price of 2*s.* 6*d.* a foot (25*s.* an ounce) and, later, magnesium in ribbon form, which the Manchester photographer ALFRED BROTHERS had found more efficient. The firm also made the first holder for burning the wire.

On 9 February 1864 Professor Roscoe read a paper 'On the use of the light of magnesium wire as a photographic agent' before the Literary and Philosophical Society of Manchester, and on 22 February Alfred Brothers took the first portrait by this new light, the sitter being Roscoe. The wire was burned at a distance of 8 ft. and the negative was said to be equal to any obtained by sunlight. On 8 March Roscoe's paper and Brothers's experiment were communicated by Sir David Brewster to a meeting of the Photographic Society of Scotland in Edinburgh in the presence of Fox Talbot, and at the conclusion JOHN MOFFAT took a portrait of Brewster and Talbot with an exposure of 42 seconds.[6] On 6 May 1864 Alfred Brothers photographed Faraday by the new artificial light after a lecture by Roscoe at the Royal Institution in London.[7] The day before, A. Claudet had given a demonstration before the Society of Arts in London, by photographing a white marble bust of Prince Albert in 30 seconds.

As the metal was still only produced in small quantities the price remained high; it was not until about 1865, when the price had fallen to 12*s.* an ounce (silver then cost only 5*s.* an ounce) that the new light-source became generally available, one of its earliest non-photographic uses being to illuminate the excavation work then in progress on the Mont Cenis tunnel. Pl 228

The first subterranean use of magnesium light for photography was demonstrated by Alfred Brothers when, early in 1864, he took a stereoscopic picture in the Blue John coalmine in Derbyshire. In May 1865 the JACKSON BROTHERS of Oldham, at the request of the Manchester Geological Society, took four views in the Bradford Colliery, but owing to the dense smoke from the magnesium wire in the 4 ft-high tunnel no more could be taken.[8]

By burning a triple strand of magnesium wire and using his miniature camera (see chapter 20) the Astronomer Royal for Scotland, C. PIAZZI SMYTH, arrived at almost instantaneous exposures when photographing the interior of the Great Pyramid in

February 1865. But here again the smoke–the great drawback of burning magnesium –lingered for hours in the chambers of the Pyramid, limiting the number of pictures to one a day.[9]

The following year CHARLES WALDACK of Cincinnati took a series of stereophotographs in the Mammoth Caves, Kentucky, under extremely difficult conditions, for the exploration of the caves involved much climbing, creeping, and squeezing through rocky and slippery places. Waldack and his two companions, Proctor and O'Shaughnessy, took with them two stereoscopic cameras, a large reflector 30 in. × 40 in., and a number of smaller ones, in which the magnesium was burned. Ten to 120 tapers of magnesium were needed for a picture (120 tapers being equivalent to 1 lb. of magnesium) depending on whether the subject was a detail or a general view. To avoid flat pictures, two-thirds of the light-source was arranged on one side of the camera and one-third on the other. Owing to the long walk to the scene of operation and the arrangement of each picture, it was only possible to make two or three negatives a day. On one occasion the party spent 35 hours in the caves, penetrating 7½ miles from the entrance.[10] When E. & H. Anthony of New York published these stereo photographs, they were regarded as a miracle of photography. Pl 230

What is possible underground should be possible above ground, thought GEORGE KENDALL PROCTOR. He designed a cave-like studio with curved ceiling and walls to reflect the magnesium light on to the sitter, and even went to the expense of patenting this arrangement in December 1868. However, we do not know of a single studio in which magnesium light was regularly used, for apart from being too harsh an illumination for portraiture, there still remained the insuperable difficulty of getting rid of the white smoke. The use of magnesium light therefore remained restricted to places where there was no other alternative. Gelatine-emulsion plates in conjunction with magnesium powder made it possible, however, to produce group photographs and, later, photographs of dinners and balls–of the kind of functions, in fact, where flashlight would be employed today.

The name 'flashlight' came into use with the introduction of magnesium in powder form in 1886, for this ignites in a flash, particularly when mixed with certain other chemicals to increase the actinic power of the light and accelerate the flash. Some of these mixtures were extremely dangerous (some photographers mixed guncotton or even ordinary gunpowder with magnesium powder) and mishaps were not rare.

Powdered magnesium had first been proposed by W. WHITE at the British Association meeting in Birmingham in 1865. 'It is a question whether magnesium in filings has met with due attention. It would not be difficult to deliver a stream of metal, as sand from an hour-glass, into a jet of gas or other flame, and thus maintain a light with a certainty equal to that obtained by wire and clockwork.'[11] G. A. KENYON revived White's idea in 1883,[12] suggesting a mixture of powdered magnesium and potassium chlorate, and subsequently this mixture became the most commonly used compound. The price of magnesium had meanwhile dropped to 1*s*. 6*d*. an ounce, and soon photographic journals and special treatises popularized flashlight photography, for example, the *Photographic News* published on 30 May 1884 an illustration showing Pl 231 the taking of a portrait by magnesium light. With skill, exceedingly good results could be obtained, the length of the flash varying according to the compound used from $\frac{1}{25}$ to ½ second. It will be evident from these fast exposures why flashlight could only establish itself in the gelatine period. Smoke formation remained a great drawback, and so-called 'smokeless' flash powders were only smokeless until lit.

LOUIS BOUTAN, a specialist in underwater photography (see chapter 39), used an electrically-ignited magnesium flash-lamp designed in 1893 by an electrical engineer named CHAUFFOUR. It consisted of coiled magnesium wire in a watertight glass globe containing oxygen and connected to a battery by fine platinum wire. When the current was switched on the platinum wire became red-hot and ignited the magnesium, producing a vivid flash which was intensified by a reflector attached to the globe.[13] Chauffour's system was a forerunner of the modern smokeless flash-bulb with electric ignition, but it had the disadvantage that as a result of the high temperature the oxygen expanded and sometimes burst the globe. An improvement patented in 1925 by DR PAUL VIERKOETTER consisted in avoiding excessive expansion by burning the magnesium wire in a near-vacuum.[14] This reduced the danger of shattering the glass bulb. The modern safety flash-bulb in general use since 1929 was introduced by JOHANNES OSTERMEIER, who substituted aluminium wire or foil in oxygen for the magnesium wire, ribbon, and other shapes specified by Vierkoetter.

ELECTRIC LIGHT

The first successful photograph by electric light was taken by FOX TALBOT in June 1851. The point of his experiment, however, was not so much the use of artificial light as the possibility of recording fast moving objects by the flash of a Leyden battery, and a detailed description is therefore postponed until the next chapter.

Three years later GAUDIN and DELAMARRE patented in France a parabolic reflector of silver-plated copper for portrait photography. The light-source was an arc lamp, and the eyes of the sitter were to be protected from the glare by a small concave mirror in front of the carbon points, which threw the light back into the reflector. In addition, a blue glass screen was placed between the light and the sitter, to diffuse the light. The exposure was 2–3 seconds for stereoscopic portraits, but despite the precautions taken, the light effect was unpleasantly harsh, and the patent was allowed to lapse.

In 1857 in St Petersburg, Count SERGEI LEVITZKY took during a lecture the first electric-light portrait.[15] His arc lamp was powered by a huge Bunsen battery of 800 elements which had been constructed the previous year for the illuminations to celebrate the coronation of Alexander II. Whether or not the portrait was successful is left to our imagination.[16]

In 1859 NADAR installed a Bunsen battery of 50 elements in his new studio in the Boulevard des Capucines. At first he practised on his staff, for the results were far too contrasty–chalk-white faces with opaque shadows, the eyes looking like sunken holes. Realizing that the shadows had to be lit up by a supplementary light source, Nadar experimented with magnesium light, ground-glass screens, mirrors, and white reflectors, and found the last mentioned the best. By 1863 he had achieved good results with exposures of 60 to 85 seconds, using wet collodion plates. Among the portraits he exhibited at the Société Française de Photographie on 21 December 1863 were Gustave Doré, Niépce de Saint-Victor, and the financiers Pereire and Mirés.[17]

Having proved the practicability of electric light for photography, Nadar about 1861 took his Bunsen 'pile' down into the catacombs and sewers beneath Paris. Since people could not pose for the 18 minutes necessary in the dark subterranean passages, in his quest to give 'life' to the scene he ingeniously introduced dummy figures in such natural attitudes as to deceive the unwary. With such a long exposure something was always liable to go wrong: sometimes the chemicals were unreliable; at others someone might let out his hot bath water, making a cloud of steam in the sewers. Nevertheless in three months' hard work 100 negatives were produced and presented to the City of Paris. Being the first photographs ever taken underground they naturally aroused much interest at the International Exhibition in London, 1862. Pl 229

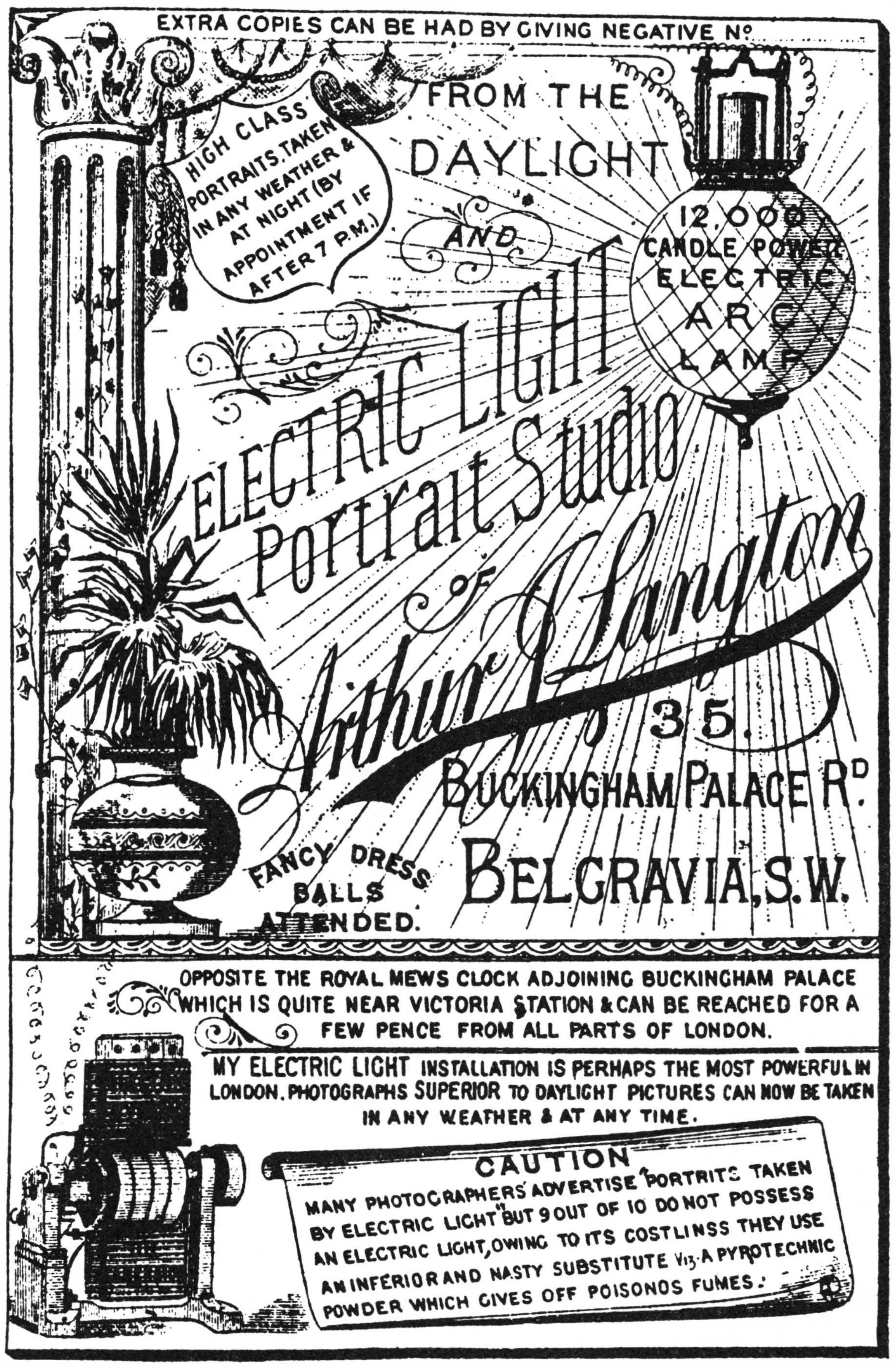
The portrait photographer ADOLF OST of Vienna improved upon Nadar's system in 1864 by using two arc lamps, the main illumination being generated by 80 Bunsen elements, while another smaller lamp powered by 40 elements was placed farther from the sitter and lower down to light up the shadows. Blue glass screens were interposed between the lights and the sitter. Ost arrived at exposures of 7 seconds (using wet collodion), but the running costs of the installation were exceedingly high, so its use was restricted to dark days. Portraits taken by electric light, up to the size of 13 in. × 16 in., were shown by Ost at the first photographic exhibition in Vienna held in May and June 1864.

Big photomechanical printing firms, and some ordinary photographic printing establishments, turned to electric light when insufficient daylight might otherwise have brought work to a standstill. The Woodbury Permanent Photographic Printing Co., for instance, installed about 1870 a powerful dynamo to provide the necessary illumination for making gelatine reliefs. The 1,200 candle-power light was a poor substitute for sunlight or daylight, its actinic power being only $\frac{1}{24}$ that of sunlight on a summer day. Compared with 10 minutes' exposure by sunlight, electric light required 4 hours to give the same result. Yet it was a great advance on the limelight formerly used at this establishment, which necessitated an exposure of as much as double that time.[18] Only big concerns, of course, could afford a dynamo, and, moreover, for portrait photography this light-source, like other artificial light, became practicable only in conjunction with fast gelatine plates.

In view of the English climate it is not surprising that the first studio in the world using electric light exclusively was opened in England. In September 1877 HENRY VAN DER WEYDE installed a powerful gas-driven Siemens dynamo in the basement of his house in Regent Street, London. The most prominent object in the studio was a huge parabolic reflector over 4 ft in diameter, painted white inside, and suspended from the ceiling by a system of pulleys enabling it to be moved about so that light could be directed on to the sitter from any point and at any desired angle. To shade the sitter's eyes from the dazzling 6,000 candle-power light, a 4 in. concave mirror (similar to Gaudin's and Delamarre's) was fixed in the centre of the reflector, the positive carbon projecting through it. In the opening of the reflector was fitted a big Fresnel lighthouse lens composed of concentric rings of prisms, which converged the
Pl 232 light rays to a point about 6 ft away. Behind the sitter were screens to reflect the light, as shown in the illustration.

This arrangement allowed Van der Weyde to take a large number of portraits in a short time. Exposures were stated to be 8 to 10 seconds for 'Promenade' portraits and 2 to 3 seconds for *cartes*. After the Prince of Wales had set the fashion for having one's portrait taken in the evening (he was photographed at midnight after the opera) fashionable ladies came for sittings in evening dress, on the way to or from the theatre, balls, or presentation at court. Indeed, it was not rare for society beauties who had sat for their portrait on the way to the opera to have proofs handed to them in their box at Covent Garden, electric light being used for printing as well as for taking the negatives.

By 1882 Van der Weyde was well on the way to making the fortune which, about six years earlier, a leading London photographer had forecast was assured to the man who invented a method of taking good portraits without daylight. It was a November day when Van der Weyde, a successful American painter whose pictures were hung on the line at the Royal Academy, had come to be photographed, only to find that the light was too bad for a successful sitting. In parting, the photographer commented upon the inventive genius of Americans and challenged him to find a way



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HIGH CLASS PORTRAITS TAKEN IN ANY WEATHER & AT NIGHT (BY APPOINTMENT IF AFTER 7 P.M.)

FROM THE DAYLIGHT AND ELECTRIC LIGHT Portrait Studio OF Arthur J Langton

12,000 CANDLE POWER ELECTRIC ARC LAMP

35 BUCKINGHAM PALACE R^D BELGRAVIA, S.W.

FANCY DRESS BALLS ATTENDED.

OPPOSITE THE ROYAL MEWS CLOCK ADJOINING BUCKINGHAM PALACE WHICH IS QUITE NEAR VICTORIA STATION & CAN BE REACHED FOR A FEW PENCE FROM ALL PARTS OF LONDON.

MY ELECTRIC LIGHT INSTALLATION IS PERHAPS THE MOST POWERFUL IN LONDON. PHOTOGRAPHS SUPERIOR TO DAYLIGHT PICTURES CAN NOW BE TAKEN IN ANY WEATHER & AT ANY TIME.

CAUTION

MANY PHOTOGRAPHERS ADVERTISE "PORTRITS TAKEN BY ELECTRIC LIGHT" BUT 9 OUT OF 10 DO NOT POSSESS AN ELECTRIC LIGHT, OWING TO ITS COSTLINSS THEY USE AN INFERIOR AND NASTY SUBSTITUTE Viz. A PYROTECHNIC POWDER WHICH GIVES OFF POISONOS FUMES.

Fig 63 Advertisement of an electric light studio in London, c. 1888

of bottling sunlight and sending it over to England, assuring him that there were 'millions in it'. 'I do not know whether it was the prospect of millions, or the great pleasure I have always felt in overcoming difficulties, that induced me to lay aside my palette and turn my studio into a laboratory' said Van der Weyde later.[19] But when after several years' experimentation he approached the same photographer with his perfected lighting system, suggesting a joint exploitation, the photographer–like all others whom Van der Weyde subsequently approached–was too sceptical to risk his money. 'They refused the millions, or any share in them, so that I was compelled to exploit the invention myself.' Owing to lack of money, the patent Van der Weyde had applied for in February 1878 was never completed, but, bearing no malice towards the sceptics, he made no secret of the details of the arrangement, and it was open to anyone to adopt it.

At the International Exhibition in Paris in 1878, the success of Van der Weyde's electric-light studio was so great that several Continental photographers followed his example, and turned their daylight studios into 'night studios'. A. LIÉBERT opened the first of these in Paris in 1879.

LEVITSKY's portraits of the Imperial family made electric-light portraiture fashionable at St Petersburg. Quite apart from fashion, artificial light was essential in the long northern winter with only 5½ hours' daylight on the shortest day.

By 1882 Vienna, Berlin, and Brussels each boasted an electric-light studio. Meanwhile the inventor was meeting competition in London. NEGRETTI & ZAMBRA opened a studio at the Crystal Palace and J. E. MAYALL's installation in Bond Street was said Fig 63 to be twice as powerful as Van der Weyde's, generating no less than 12,000 candle-power.[20]

> The progress that has been made during the year in electric lighting, by myself and others [wrote J. W. SWAN, inventor of the incandescent filament bulb, in 1880] fully warrants the expectation that before long the electric light will be within easy reach of most photographers. . . . It is almost a matter of certainty that in a short space of time electric conducting wires will be laid along the streets of large towns, as gas mains are laid, and that through these wires an electric current will be supplied to houses and shops and photographic studios. When this state of things is reached, the adoption of the electric light in the practice of photography will be easy and comparatively inexpensive.[21]

Swan was somewhat over-optimistic. Only a few electricity companies were formed in the early 1880s, and these in due course supplied current to certain districts of London and some of the major provincial cities, but electricity did not become generally available even in towns until the early years of this century. The charges for wiring were usually about one-eighth of the expense of a dynamo and engine, which cost between £300 and £500 according to the power generated. In addition, such an installation was expensive to run and to keep in repair, and until sixty or seventy years ago only leading studios could afford electric light.

GAS LIGHT

Compared with magnesium and electric light, gas was a feeble source of illumination; each Bunsen burner with a mantle was equivalent to only about 60 candle-power. The application of gas to photography therefore demanded a large number of burners, but a limit was set by the great heat generated. Nevertheless, a few provincial studios used gas lighting augmented by reflectors, in imitation of the London electric-light studios. That of P. MAITLAND LAWS of Newcastle-on-Tyne was one of the first (about 1880), using a Wigham burner with 68 jets and yielding 1,250 candle-power. A movable reflector lined with silvered glass was suspended from the ceiling over the burner. The sitter was shielded from the heat by a blue glass screen. Exposures were, of course, several times as long as with electric light, and Laws regarded the whole installation only as an auxiliary for the winter season, but to his dismay clients were so infected with the craze for artificial light photography that they demanded gas-light portraits even in the middle of the summer.

'LUXOGRAPH'

The demand for an artificial light source which was practicable and within reach of the general run of photographers brought about a revival of pyrotechnic light. The 'Luxograph' of Alder & Clarke, patented in April 1878, enjoyed some popularity in England on account of its cheapness compared with electricity and its avoidance of the unpleasant characteristics of gas and magnesium. The apparatus had a 4-ft reflector lined with silvered glass and was made in two sizes, for half-length and for full-length portraits, costing £35 and £50 respectively. Fitted with wheels, the Luxograph could be easily moved about, and semi-transparent screens interposed between sitter and light-source softened the effect. The compound was ignited by a gas jet, and the cost per exposure was stated to be about *2d.*[22]

34 The photography of movement

Though stereo cameras and some early hand cameras made the taking of instantaneous photographs possible from the mid-1850s (see chapter 20), after 1880 action photographs were no longer confined to a comparatively few enthusiasts. Professional photographers continued to work with stand cameras, carefully composing their pictures; the hand camera made the amateur independent of the tripod: it could accompany him wherever he went, and he could take pictures of everyday occurrences outside the scope of large plate cameras. The public immediately began to develop a liking for unaffected open-air portraits in natural surroundings and without retouching. Snapshots of country outings, boating, close-ups of street scenes, people at play, horse-riding, a bather suspended in mid-air as he dived into the stream, a stormy sea were now all subjects within the range of photography, and this concentration upon the things immediately about them was certain to have an important modifying influence upon pictorial photography. Pl 234

At photographic exhibitions–mostly ruled by the old school of pictorial photographers–instantaneous studies which had at first caused a sensation were soon criticized for lack of composition, meeting with the same sort of reaction as Impressionist paintings did from conservative Academicians. There is, in fact, a closer link between Impressionism and instantaneous photography than merely similar subject-matter and unconventional presentation. The impact of photography on the Impressionists cannot be overstressed, and it is curious that this influence should have received so little attention from art historians who ascribe the new vision solely to the influence of Japanese prints, for had not painting been influenced by photography since the mid-1840s? It is no mere coincidence that the first Impressionist exhibition was held in the studio of the photographer Nadar, but, having touched upon the inter-relation of photography and painting in other publications[1] and intending to publish a fuller study in the future, we here confine outselves to quoting an art critic of the period:

> Today, open-air photography imbues the artist's work with fresh pulsating life, offering him a thousand valuable hints. . . . The camera now forms an essential part of studio equipment; out of doors it stands next to the painter's easel. If formerly the painter was only active under his sunshade, now he puts his head just as often under the black focussing cloth. In a hundred cases, if you go into a modern painter's studio you will find that the owner is busy in the darkroom. Artists who do not use the camera are in the minority. . . . The often tasteless representations of instantaneous photographs with their grotesquely incorrect perspective, enjoy

> great popularity when copied on canvas in oils, and win the special respect of the critics.[2]

A similar opinion was expressed in the *St James's Gazette*, London, 1886. Unfortunately photographs are not usually so well cared for as paintings, and snapshots of the 1870s which may have served the Impressionists as models are not easily obtainable. In all probability they were destroyed after they had served their purpose. Meanwhile, some photographs of the 1880s may support our contention. Pls 233, 235-237

CHARLES A. WILSON's and the London Stereoscopic Company's views of London in the mid-1880s show that Oxford Street and Fleet Street were nearly as crowded in the days of bustles and tricycles, horse-buses and hansom cabs, as they are today. Such lively photographs of life and movement in important thoroughfares had been a dream of Wilson's father thirty years earlier. C. A. Wilson's pictures were not taken with a hand camera–which professional photographers at the time despised as a toy only fit for amateurs–and he had to resort to other means of accomplishing his task. Pls 238, 239

> We used to hire a covered van from Pickford's, and stand with our 10″ × 12″ camera under the awning, fairly well out of sight of the passers-by, and then with the lens ready focussed and capped and a dark slide inserted ready to draw, used to direct the diver to stop near the curb opposite some specified building, while we would watch our chance to make an instantaneous exposure.[3]

PHOTOGRAPHIC ANALYSIS OF MOVEMENT

For the scientific study of motion special equipment was needed, and in this field photography extended observation beyond the former limits of human perception. In reading the secrets of motion, instantaneous photography was an addition to scientific research in the nineteenth century comparable with microscopy in the seventeenth.

As early as December 1867 ALFRED A. POLLOCK, an amateur photographer, suggested taking, on a circular rotating plate, a series of fifty instantaneous photographs of a man walking, and then arranging the positive prints around a disk as in the phenakistiscope or stroboscope. If the series of pictures was viewed through a slotted disk 'the image might walk at the same pace as the subject had done'. Pollock was confident that as soon as negative material was sensitive enough it would be possible to show the movement of a horse and the wagging of a dog's tail.[4]

In 1874 the French astronomer PIERRE JULES CÉSAR JANSSEN designed the first automatic camera for chronophotography, to record the transit of the planet Venus across the sun (8 December 1874). The apparatus, inaptly called a revolver, was set up in a dark room and focused on a heliostat to keep the sun's image stationary. Forty-eight photographs were taken in succession, at intervals of 70 seconds, around the edge of a circular daguerreotype plate, which was rotated by clockwork and stopped by a Maltese cross movement for the period of each exposure. In front of the plate was a stationary disk with a single aperture, and a shutter disk with twelve openings which revolved four times faster than the sensitive plate. Each time an opening of the shutter disk passed the aperture of the stationary disk an exposure was made. The use of a daguerreotype plate at this late date calls for explanation. As the whole procedure lasted nearly an hour, wet collodion was not a suitable medium. Apart from this, a glass plate would have caused halation, and for this reason astronomers for a long time continued using daguerreotype plates to photograph the sun.

Janssen, as well as Pollock, foresaw the possibility of rapidly recording with such an instrument a whole cycle of movements of animals and birds for the purpose of solving problems of physiological mechanism, provided faster plates were invented.[5] His suggestion did not pass unheeded, for after the introduction of gelatine plates DR ÉTIENNE JULES MAREY reverted to Janssen's type of camera for recording the movement of birds in flight. Pl 245 Marey, who had studied medicine to please his father, was professor of medicine at the University of Paris, but a life-long preference for mechanical science led him to the invention of a great many physiological recording instruments. From researches on the circulation of the blood he turned to the investigation of muscular movement, eventually devoting himself entirely to the study of movement of animals and insects, on the earth, in the water, and in the air (a subject which had engaged the attention of physiologists since the middle of the seventeenth century), and in 1869 he was appointed professor of natural history at the Collège de France.

Marey's chronography. Marey devised various apparatus for recording chronographically the consecutive movements of animal locomotion. To determine the gait of horses, for instance, he fitted a rubber ball in each hoof, with a tube leading to a revolving cylinder with paper wound round it, which was held by the rider. When the pressure of the horse's hooves compressed the rubber balls, air was forced up the tubes, and caused four tracing needles to record the length of contact of each hoof with the ground. The notations were transcribed by Colonel Duhousset into drawings of the horse in motion, which appeared animated when exhibited in the zoetrope.[6]

Muybridge's photographs of the horse in motion. Some improbable-looking attitudes of the horse, which were published in one of Marey's articles, led to a dispute between Leland Stanford, ex-Governor of California, and his friend Frederick MacCrellish, both great horse-lovers. As the latter could not believe that a fast trotting horse ever has all its feet off the ground at the same time, it occurred to Stanford to call in EADWEARD MUYBRIDGE[7]–who was engaged at the time in making a photographic survey of the Pacific Coast for the U.S. Government–to settle the controversy by photography. However, the photographs which Muybridge took in May 1872 at the race-course at Sacramento were inconclusive, according to the official account[8] (because he lacked a quick-acting shutter), but Muybridge claimed that one of his photographs did prove that Stanford was right.

Some time after these experiments Muybridge had to leave the United States after killing his wife's lover. On returning to San Francisco in 1877, he resumed his investigations of the horse's gait at Stanford's stud farm, Palo Alto. His first subject was Stanford's racing trotter 'Occident', whose dark colour showed up well against a white screen, in front of which the horse passed at a speed of $22\frac{1}{2}$ miles an hour, and at a distance of approximately 40 ft from the camera. Though the negatives were necessarily under-exposed, being taken in $\frac{1}{1000}$ second, one of the resulting silhouette pictures showed the horse with all its hooves clear of the ground, thus settling the old controversy at last.

The success of this experiment encouraged Stanford to have it repeated on an extended scale by increasing the number of cameras and arranging them in a row parallel to the running track, with the object of obtaining at short regular intervals of time or distance several consecutive phases of the horse's movement during a single complete stride. This method of recording movement was not so original as it might seem. In 1860 THOMAS ROSE, an amateur photographer, suggested using 100 stereoscopic cameras in a row, giving exposures of $\frac{1}{6}$ second at intervals of the same duration. The positive prints were to be mounted in pairs on a large phenakistiscope disk, Pl 240 which, when revolving, would reproduce the action of life in stereoscopic relief–i.e. a three-dimensional moving picture.[9] Stanford and Muybridge anticipated that, with a battery of cameras, a more complete investigation of the successive positions of animals in motion could be accomplished than by Marey's chronographic method. Stanford backed the continued investigations without regard to expense. Indeed, by the time they were concluded, his total outlay was said to have amounted to 40,000 dollars. Muybridge was authorized to have the necessary equipment made and Stanford had a special running-track laid at Palo Alto, covered with corrugated rubber to avoid dust. On one side of it a 40-ft-long camera house incorporating a darkroom was erected, and on the other a slanting fence 50 ft long and 15 ft high, covered with white cotton material marked with vertical lines at intervals of 21 in., the spaces being consecutively numbered. In front of the screen was a baseboard with four horizontal lines 4 in. apart, to show how high the horse raised its feet from the ground. Twelve small cameras were placed along the studio shed at intervals of 21 in., each fitted with a quick acting electro-magnetic shutter set off in succession by clockwork. The electrical installation was devised by John D. Isaacs of the Central Pacific Railway. The arrangements were ready by the beginning of June 1878.

As it was found exceedingly difficult to time the arrival of the horse opposite each camera to coincide with the opening of the shutter, Muybridge immediately adopted two other methods better suited to the regular movement of the horse, retaining the first system for the irregular movements of other animals.

In the case of a trotting horse harnessed to a sulky, wires were laid partly across the track in such a way that only one wheel passed over them, completing the electric circuit to the shutters.

When a horse ran alone, or with a rider, threads were fastened across the track at breast height, one to each camera. In running through, the horse broke the threads and closed the circuit, its progress regulating the interval between the exposures. These were at various times estimated by Muybridge to be $\frac{1}{2000}$, $\frac{1}{3500}$ and $\frac{1}{5000}$ second, but considering that wet collodion plates were used they are not likely to have been shorter than $\frac{1}{1000}$ second. Indeed, according to a more careful calculation of exposures in the photographs taken for the University of Pennsylvania in 1884–5 with gelatine dry plates, $\frac{1}{2000}$ was only rarely necessary for extreme rapidity of movement, whilst $\frac{1}{600}$ to $\frac{1}{800}$ second proved quite short enough to catch the stride of a horse, and $\frac{1}{200}$ second sufficed for most of the slower movements,[10] and it is extremely unlikely that the exposures were faster for the slower collodion plates.

Muybridge suggested that by applying this arrangement to horse-racing it would be possible to avoid dead-heats, adding, 'In an important race the decision of the camera would be preferred to that of the judges,' and in May 1882 he predicted in a letter to *Nature* that 'in the near future no race of any importance will be undertaken without the assistance of photography to determine the winner'. Actually, a photo-finish was first recorded in the summer of 1888 by Ernest Marks of Plainfield, New Jersey, official photographer to a racing association. He had an improvised darkroom at the race-course, and was able to hand the negative to the judges within 3 minutes.[11]

In order to analyse still more closely the movement of animals, in the summer of 1879 the number of cameras was further increased to twenty-four, arranged with the centres of their lenses 12 in. apart. The lines on the background were increased accordingly. For head-on views, back views, and diagonal views, two additional cameras were placed at each end of the track, so that photographs were taken at five different angles. Owing to the extremely short exposures the photographs were lacking in detail, but were clear enough to allow an analysis of the various movements, confirming the correctness of Marey's chronography. Muybridge issued a number of photographs for sale under the title 'The Horse in Motion', and registered them for copyright at the Library of Congress, but this was not a book publication, as is often assumed, and should not be confused with the rare quarto volume of the same title written by the anatomist J. D. B. Stillman in 1882. In this official account, as in the many American and European magazines which publicized the results of the investigation, Muybridge's photographs were reproduced as line drawings (with the exception of two heliotype plates in the book) and they challenged all preconceived notions of animal movement, arousing the anger and ridicule of many artists who did not want to recognize the truth when they saw it.

Instantaneous photography exposed the conventional 'rocking-horse' attitude of galloping horses as a fallacy.[12] (In a similar way it was to prove a few years later the traditional zigzag representation of lightning as an absurdity.) Muybridge also showed that the most famous animal painters of the day–Landseer, John Frederick Herring, Sidney Cooper, Rosa Bonheur, and Meissonier–depicted other positions which animals can never assume.

Stone-age men appear to have had a far better grasp of animal movement, and indeed up to the nineteenth century there have been many artists who successfully represented it, but they did not attempt the impossible–to represent a fast galloping horse, seen by nineteenth-century artists as a horse with its legs extended fore and aft, flying through the air.

Instruments demonstrating the persistence of vision. Since the consecutive positions of the legs in the stride of a horse as revealed by Muybridge's photographs were criticized as being ludicrous and impossible, he followed Marey's advice to demonstrate them in the zoetrope, and later in the zoopraxiscope, to convince the sceptical of the correctness of the photographic analysis. In the instrument invented by **W. G. HORNER** of Bristol in 1833 (and named zoetrope in 1867) a series of drawings was arranged round the inside of a slotted drum which, when revolved, produced animated pictures. The zoopraxiscope devised by Muybridge in 1880 was based on the phenakistiscope of **DR PETER MARK ROGET, F.R.S.**, and the stroboscope of **SIMON VON STAMPFER**, invented independently in London and Vienna in 1831 and 1832 respectively, to demonstrate the persistence of vision. **JOSEPH PLATEAU** is generally incorrectly credited with the invention of the phenakisticope (as he spelt it): he himself denied[13] having a hand in the execution of it, adding 'a much more perfect instrument made according to my design is now on sale in London under the name "Fantascope", originally named "Phantasmascope".' The phenakistiscope was in fact invented by Roget,[14] who first drew attention to optical deception through movement in a communication to the Royal Society in December 1824. Both Faraday and Plateau acknowledged their indebtedness to him for their subsequent researches in this field.

In these scientific toys a number of pictures of different phases of a movement were arranged round the edge of a cardboard disk. In the case of the phenakistiscope, they were viewed by rotating the disk in front of a mirror and looking at the images through a number of slots arranged around the edge of the disk. In the stroboscope they were viewed through a second slotted disk. On making the disks revolve rapidly, the observer gains a momentary view of each picture in the series as each slot arrives opposite the respective image. Owing to the persistence of vision, all the pictures blend on the retina, giving a life-like impression of a figure in motion. **FRANZ VON UCHATIUS**, an Austrian officer, was the first to *project* animated effects on to a screen, painting figures round glass disks and illuminating them by a magic lantern. His apparatus was put on the market by a Viennese optician in 1853. Eleven years later a phenakistiscope with transparent pictures for projection was listed in J. Duboscq's catalogue of optical apparatus. THOMAS ROSS, who patented his 'wheel of life' in 1871, conceived the idea of having the figures *photographed* or painted on the glass disk. In June 1879 the London sporting paper *The Field* drew crowds to its office window by exhibiting one of Muybridge's series in a zoetrope worked by a small electric motor.[15] In August of the same year the London scientific instrument makers Horne & Thornthwaite demonstrated before the British Association meeting at Sheffield the praxinoscope invented by the Frenchman ÉMILE REYNAUD two years previously, which they made topical by projecting in it a series of drawings from Muybridge's pictures, calling it 'an instrument for showing the paces of the horse by means of instantaneous photographs'.

Muybridge's zoopraxiscope was an essential advance upon all the earlier inventions. It was the first instrument in which actual photographs (not drawings copied from photographs) were projected–though even these had, at first, to be considerably touched-up for the purpose of screen projection. Muybridge could now demonstrate by synthetical reconstruction the movements which had been analytically photographed from life–and they were displayed so realistically that no one could hesitate to concede the truth of what had at first seemed impossible or absurd. The animated projection conclusively demonstrated that the attitudes which appeared so startling in some individual photographs actually formed part of a graceful, harmonious, and natural action.

After finishing the photographic work at Palo Alto in autumn 1879, Muybridge devoted the next three years largely to lecturing in America and Europe, starting in San Francisco on 4 May 1880. The San Francisco newspaper *Alta* reported: 'Mr Muybridge has laid the foundation of a new method of entertaining the people.' Audiences everywhere were delighted with the animation of his pictures, which he contrasted with the attitudes depicted by celebrated artists of the day.

Marey welcomed Muybridge to Paris in August 1881, and arranged for a demonstration before an audience of scientists who had come from all countries to attend the Electrical Congress. Marey had followed Muybridge's investigations in California with keen interest, and the two experimenters were on the friendliest terms and constantly encouraged each other.

Marey's soirée was such a success that Meissonier arranged at his studio another demonstration which ranked as one of the most important social events of the year. Meissonier thought he had nothing new to learn from photography–for had not the Government gone to the length of laying down in his grounds a track so that he could be propelled at the same rate as a trotting or galloping horse on a parallel track? Had he not thus confirmed by careful observation the exact mode in which the horse's hooves are put down? Convinced at last of the truth revealed by Muybridge's photographs, Meissonier was the first artist publicly to acknowledge his debt to his researches: he repainted the legs of Napoleon's charger in a picture he was working on, and henceforth put his trust in chronophotography rather than in his own powers of observation.

Muybridge next lectured in Berlin, and in the spring and summer of 1882 gave demonstrations in London at the Royal Society, the Royal Academy, the Society of Arts, and at the Royal Institution, when the Prince of Wales presided and the audience included The Princess of Wales, Gladstone, Huxley, Tyndall, Frederick Leighton, and Tennyson. Wherever Muybridge lectured people flocked to see the moving-picture show of horses trotting, galloping, and jumping over hurdles, deer leaping, birds flying, athletes wrestling and turning somersaults, etc., 'just as if it were all happening in real life'. It was a sensation no one wanted to miss. Scepticism was overcome, and the influence upon art of Muybridge's work was incalculable, though many artists maintained, not without reason, that if they were to depict the attitudes which Muybridge had proved correct, they would represent positions too fleeting for the human eye to perceive. Hence, it could be argued, fast animal movement is a subject ideally suited to photography, but not to painting–if naturalistic representation is regarded as the ideal, as it was in the nineteenth century.

Muybridge's photographs taken in Palo Alto in 1878 and 1879 had demonstrated certain movements, but with the comparatively slow wet collodion plates it had been impossible to obtain essential details of rapid muscular action. When the highly sensitive gelatine dry plates came on the market, he was convinced that a more systematic and comprehensive investigation would provide a great deal of further information.

Muybridge's investigations for the University of Pennsylvania. So far Muybridge had only pointed the way to a new field of research, but thorough investigation would involve heavy outlay, and all the publishers whom he approached after his return to the United States in October 1882 shrank from the magnitude of the scheme. But one J. B. Lippincott, a benefactor of the University of Pennsylvania, interested the Provost, Dr William Pepper, in the contemplated investigation. The University was willing to sponsor the work, provided that a scientific committee of the University should supervise it. THOMAS EAKINS of Philadelphia, America's super-realist painter, who based his art on scientific principles, was a member of this committee. He was critical of Muybridge's use of a battery of cameras instead of Marey's single camera method. Constructing a camera with two disk shutters, one revolving eight times as fast as the other, and making nine or ten exposures on one plate, Eakins–contemporaneously with Muybridge–made an independent series of experiments for the University, and produced pictures of horses and nude athletes which are practically Pls 250, 251
indistinguishable from Marey's. Pl 249

In the spring of 1884 Muybridge recommenced work, this time making use of three batteries of twelve cameras for taking front, side, and back views. The cameras were electrically operated by a clockwork device which made it possible to vary the exposures and the intervals between them, for slow or quick action. Twelve successive exposures made from three different points of view simultaneously could be completed in $\frac{1}{5}$ second.

The general arrangements were similar to those at Palo Alto, but to facilitate calculation of the movements, the canvas background was divided (like graph paper) by cords into 20 in. squares, each subdivided into 2 in. squares. If the subject was light coloured the canvas was black and the cords white; if the subject was black, white canvas was used with black cords. The distance between cameras and subject was usually 49 ft. Slow movements were photographed with lenses of 3 in. diameter and 15 in. focal length, the centres of the lenses being 6 in. apart. Rapid movements were taken with lenses of $1\frac{1}{4}$ in. diameter and 5 in. focal length, the centres of the lenses being 3 in. apart.[16] From these figures the width of the cameras can be deduced as 6 in. and 3 in. across the front, the plate size for the latter being approximately 1 in. × $1\frac{1}{2}$ in.

Human movement was recorded for both sexes and all ages, clothed and naked, at work and at play, and in almost all possible actions, the majority of the models being students or graduates of the University. Wild animals were photographed at the zoological gardens of Philadelphia in the summer and autumn of 1885, after which the investigations were terminated. It was then said that more than 100,000 plates had been exposed and 30,000 dollars spent. To recover some of the outlay and to make the results generally available, the work was published in 1887 as *Animal Locomotion, an electro-photographic investigation of consecutive phases of animal movement* with text by Dr H. Allen, professor of physiology at the University. The plates, not counting the margin, vary from 12 in. high × 9 in. wide to 6 in. high × 18 in. wide, and were printed by the Photogravure Company of New York. The work comprised 781 collotype plates bound in eleven folio volumes, containing over 20,000 figures of moving men, women, children, animals, and birds, and remains to this day the most comprehensive publication of its kind. The high price of 600 dollars (then about £150) restricted the sale of the complete work to 37 libraries and institutions,[17] but hundreds of selections were subscribed for by the leading artists and scientists on both Pls 242, 243 sides of the Atlantic. For such selections the price was 100 dollars for 100 plates.

With a view to making his *magnum opus* available to a larger public, Muybridge decided in 1898 to republish the most important plates on a reduced scale by the half-tone process. The two volumes, *Animals in Motion* and *The Human Figure in Motion*, originally published in 1899 and 1901 respectively by Chapman & Hall, London, have since been reprinted several times and are consequently more widely known than the rare original publication. Muybridge also had lantern slides made by G. W. Wilson of Aberdeen, to whom he sent a number of copy negatives on sheet film.[18]

Pl 241 In 1900 Muybridge, now looking very much like God the Father in Blake's illustrations, returned to his birthplace, Kingston-on-Thames near London, which he had left in 1852. He bequeathed to the public library there his zoopraxiscope, press-cuttings books, a large selection of the Pennsylvania plates, some lantern slides, and £3,000 for the purchase of reference works.

Marey's chronophotography. Just as Muybridge's work had originally been instigated by Marey's researches, so Muybridge was the direct cause which led Marey to abandon, in 1882, his chronographic methods in favour of chronophotography which afforded a more striking demonstration.

Soon after his meeting with Muybridge, Marey, reverting to the idea of Dr Pl 246 Janssen's 'revolver', devised a photographic gun[19] which he aimed at flying birds like an ordinary rifle, the pictures being taken round the edge of a circular revolving plate. At the end of the barrel, which could be extended or shortened like a telescope so as to focus the image, was a lens of long focus; near the butt end of the barrel was a cylindrical magazine containing the circular gelatine dry plate; in front of it in close contact was an opaque disk with twelve apertures, and in front of both another opaque disk with only one opening. On pressing the trigger a clockwork mechanism caused the three disks to rotate. The photographic plate and the disk with twelve apertures revolved once in a second, being stopped at intervals of $\frac{1}{12}$ second for each exposure of $\frac{1}{720}$ second.[20] On account of its weight, the glass plate could not revolve more rapidly, and the number of images was limited to twelve a second. In this way Marey obtained at short intervals successive images showing the different phases of Pl 247 a movement. The photographs of the flight of birds[21] were the most remarkable results so far obtained. They were extremely small, but Marey modelled larger images in wax, and their animated effect was exceedingly realistic when exhibited in the zoetrope. They showed clearly the down-stroke of the wings, which only the ancient Egyptians and the contemporary Japanese ever thought of illustrating.

Marey did not confine his studies to animals, birds, and insects; he also photographed marine life in an aquarium set in the window of a darkroom with light shining through the water.

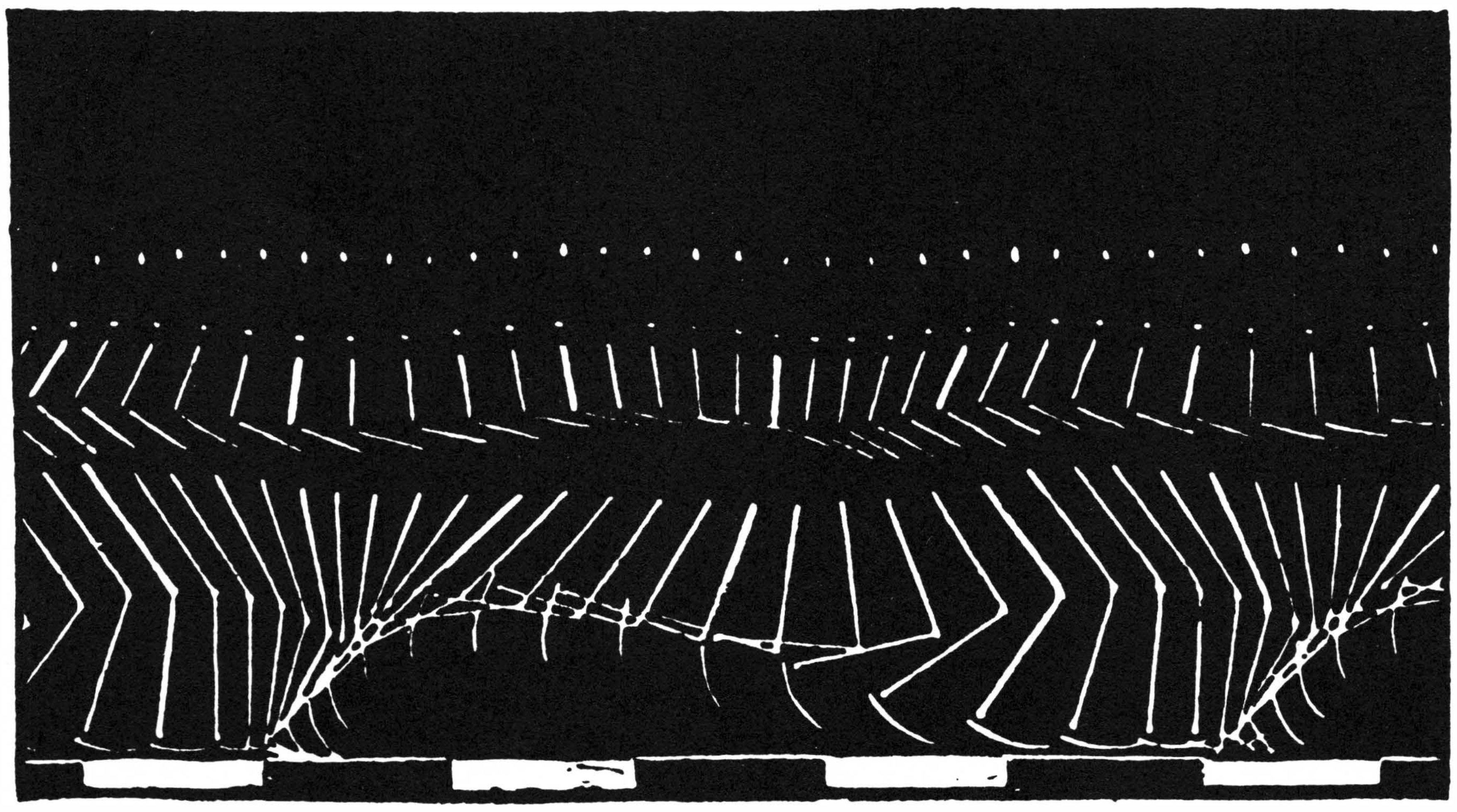

Fig 64 E. J. Marey. Linear graph of running man wearing black with white stripes, c. 1882

For the photography of animals and human beings Marey had a deep open-fronted shed constructed, about 36 ft long and 13 ft high, in the grounds of the Physiological Station in the Bois de Boulogne, Paris. This shed was lined with black velvet to form a perfectly black cave-like background, in front of which light-coloured animals, or men dressed in white were made to pass in bright sunshine. Pl 244

In contrast to Muybridge's battery of cameras, which represented movement as seen from twenty-four slightly different viewpoints, Marey preferred to record the impression which one observer following the movement would obtain, and he photographed the consecutive phases of movement on a single dry plate. The essential feature of his otherwise ordinary bellows camera was a disk shutter with radial slots which was placed in front of the plate, and uniformly rotated by clockwork (or by a crank and regulator), giving a series of consecutive exposures of $\frac{1}{5000}$ second at intervals of $\frac{1}{10}$ second.[22] The camera was set up in a movable darkroom wagon running on rails, to vary its distance from the track according to the size of the subject. It was found, however, only suitable for photographing small fast-moving creatures, for if the movement were slow (a walking man) or the animal long (a horse), the images had a tendency to overlap on the plate owing to the very short intervals between the exposures. In the case of human beings, the difficulty was overcome by dressing a man in black velvet and marking the arm and leg on the side facing the camera with lines and points of white shiny material, resulting in a linear graph of his arm and leg movement. (In the case of a large animal, the sequence had to be photographed on a moving film band, but this was not attempted before 1887.) Pls 248, 249 Fig 64

Cinematography. In 1887 Marey devised a chronophotographic camera to take photographs 9 cm. square ($3\frac{3}{5}$ in.) on a roll of sensitized paper. Three years later he replaced the paper with Balagny's transparent celluloid film, following hard on the heels of FRIESE-GREENE and MORTIMER EVANS in inventing a ciné-camera. The camera was fitted with two magazines, one containing the paper (or film) which was unrolled in a series of intermittent movements, coming to rest at the moment of exposure, and the other containing the second spool on which the exposed film was rolled up again. The film was kept tight by a compressor and the feed motion was effected by a cam; the exposure, lasting $\frac{1}{1000}$ second, was made by two slotted disks rotating in opposite directions. The sensitive band was finished off at each end with a length of opaque paper to protect it from light, so that it could be loaded and removed in the open air–the first daylight-loading spool. The whole mechanism was put in motion by turning a crank, and the moment the animal began to run, the operator pressed a trigger to start the film: photographs were taken as long as pressure was maintained on the trigger. The 'chronophotographe' enabled Marey to secure a much longer and more rapid series of pictures than had ever been possible before–as many as sixty exposures a second could be made, and much better photographs were obtained of the rapid movements of birds than with the gun camera. Unfortunately while Marey was trying to improve his ingenious invention he learned that his assistant GEORGES DEMENY had made a small modification to it and had thus been able to take out a patent in his own name.[23]

In 1896 Marey perfected his chronophotographe. He now obtained perfectly equidistant images–without the usual recourse to perforation of the film and to pegged rollers. Because of the inertia of the film spools he found it more satisfactory to keep them constantly revolving, but a small part of the film was arranged in a loose loop between two sets of feed-rollers, and this loop was suddenly straightened out in front of the lens, remaining stationary for the exposure. It was then jerked on again, and was steadily wound on to the receiving spool. This is the method in use in ciné-cameras (but with perforations).[24]

Marey not only photographed motion, but also projected it in cinematographic form. In May 1892 he had described to the Académie des Sciences (of which he was elected President in 1895) a projector in which sixty or more positives printed on a transparent film band were thrown on a screen by electric light. Though his pioneer work in cinematography was subsequently overshadowed by the improved apparatus of the more businesslike Lumière brothers, just as William Friese-Greene was overshadowed by Thomas Edison, we should not forget the originators, however brilliant the improvers.

A comprehensive and well illustrated summary of chronophotography in all its applications is given in Marey's *Le Mouvement*, Paris, 1894, of which an English translation was published in London the following year. This work ranks as a classic in physiological science and has been somewhat loosely acclaimed as the first book on cinematography.[25] After Marey's death Professor LUCIEN BULL at the Institut Marey in Paris continued the researches to which its founder had devoted his life, and published them in the *Travaux de l'Association de l'Institut Marey*.

Marey was not the only person stimulated to experiment with animated photography by Muybridge's work. A host of others took up the idea, but realizing that a battery of cameras was both expensive and impracticable for the further development of animated photography towards cinematography, they–like Marey–tried to secure similar results with a single camera and from one point of view. Success in the reproduction of motion was not possible until improvements in the manufacture of celluloid provided a long thin strip of sensitized material (1889) upon which any desired number of photographs could be taken in rapid succession (at least sixteen per second–the minimum speed at which persistence of vision functions). Glass disks were severely limited in their picture-holding capacity. Even in the most successful instrument of this type, the Kammatograph (1898) with up to 550 tiny photographs arranged spirally round the edge of a 12 in. diameter disk, the running time of the projected pictures was only 45 seconds–obviously too short for commercial purposes. Indeed, LEO KAMM exhausted the possibilities of animated photography on glass.

Pre-eminent among the early experimenters and inventors of cinematographic apparatus using celluloid film were–besides Professor Marey and Georges Demeny –the brothers AUGUSTE and LOUIS LUMIÈRE in France; THOMAS EDISON in America;

and in Britain WILLIAM FRIESE-GREENE and E. MORTIMER EVANS, LOUIS LE PRINCE, ROBERT W. PAUL, and BIRT ACRES. Their work belongs to the history of cinematography, and we return now to other photographers of movement, who photographed either merely for amusement like COUNT ESTERHAZY and S. C. SCOLIK in Vienna, Pl 253 or professionally like O. ANSCHÜTZ, and F. BOISSONNAS and A. LUGARDON of Geneva.

The work of Anschütz. In 1882 OTTOMAR ANSCHÜTZ, a photographer in Lissa, then in Prussia (now Leszno, Poland), began making photographic studies of a large variety of animals which he kept on an extensive estate adjoining his house. His well-chosen poses of them in more or less free condition induced the Breslau Zoo to make similar facilities available to him there. Hitherto animals of prey had only been photographed in cages which restricted their movements and influenced their habits, and Anschütz's pictures were therefore particularly valuable to artists. Though these were taken instantaneously, real action shots were only attempted two years later: horses jumping, a kangaroo leaping, a pack of hounds running, etc. From single photographs Anschütz progressed to complete series, and one of his greatest triumphs was a set of 120 photographs illustrating the life of a family of storks, for which purpose he had built a hide opposite their nest. People were delighted to see close-ups of the parent storks standing in the nest and of the different stages of development of the young; while particular interest was aroused by photographs of the stork alighting and 'taking off' from the nest, for such pictures had not hitherto been taken. In one Pl 252 the stork exhibited a curious humped and headless appearance. All these pictures were taken with a small hand camera which Anschütz had fitted with a focal-plane shutter, to obtain exposures as short as $\frac{1}{1000}$ second, and which later became well-known as the Goerz/Anschütz camera.

Anschütz also photographed the gait of the horse at various Prussian stud farms, and this led to an order from the Prussian War Minister for a set of pictures at the military riding school in Hanover, for equestrian instruction. Taking up Muybridge's system in 1886, Anschütz used a battery of twenty-four tiny cameras, in which by an automatic shutter mechanism such rapid exposures could be given that the entire leap of a horse, subdivided into twenty-four positions, could be taken in $\frac{3}{4}$ second. Such rapidity of exposure was made possible by the use of lenses of very short focal length in conjunction with tiny negatives measuring a mere 2 cm. (about $\frac{13}{16}$ in.) square. Continuing his work with the official support of both the War Minister and the Minister of Education, Anschütz next photographed troops in marching order, gymnasts turning somersaults, clearing the vaulting-horse, leaping from the springboard, etc. He also attended army manœuvres, and his photographs are today as valuable as documentary material showing the fighting formations of the period, as they were at the time to the painters of battle scenes who eagerly copied them.[26]

For showing his pictures in motion Anschütz in 1886–7 had the Tachyscope or Schnellseher constructed. This consists of a shallow metal drum on a stand with an arm which made it possible to use the drum vertically or horizontally. Unlike the zoetrope the drum was not slotted, but instead the cardboard picture band which formed the rim of the drum. The sequence of movement–a flying stork, bucking donkey, jumping horse, marching soldier, etc.–had been copied from the photographs on to these bands (later they were printed by lithography). In the zoetrope the drawings were made to suit the number of slots in the drum, but in Anschütz's picture bands each picture sequence required its own particular number of slots to complete the cycle of phases of movement. For public exhibition enlarged diapositives, each 10 cm. square, were made and arranged in sequence round the circumference of a large steel stroboscopic disk mounted on a stand. Behind the top of the disk at eye-level was a ground-glass plate to diffuse the flash of a Geissler vacuum tube, which was connected with Bunsen elements. When the disk was revolved rapidly, a spark illuminated each of the transparent pictures in succession, allowing several observers standing in front of the apparatus to view the motion pictures. Anschütz also exhibited his Electrotachyscope, constructed in 1887 to the order of the Prussian War Minister, to audiences in Berlin and Vienna.[27] Strictly speaking, however, it was only suitable for the educational purpose for which it had been designed. Only comparatively few (up to ninety-four) pictures could be carried on the rim of the wheel, and the subject was exhausted in a few seconds and another wheel with fresh pictures had to be fitted. The chief drawback of the apparatus was the fact that it was a viewing and not a projecting instrument, limiting the audience to a few people at a time.

In the Bioscope which GEORGES DEMENY invented in 1892 to reproduce the movements he had photographed with his Photophone, the pictures were arranged round a glass disk as had been done in Muybridge's zoopraxiscope, and projected onto a screen. This arrangement proved to be a great improvement upon Anschütz's Electrotachyscope.

Multiple lens cameras. The use of a battery of cameras such as Muybridge and (sometimes) Anschütz employed, gave LOUIS LE PRINCE and ALBERT LONDE the idea of recording rapid movement with one camera incorporating multiple lenses of equal focus. Londe, who was in charge of the photographic service at the Salpêtrière lunatic asylum for women, constructed such a camera for making studies of the actions of the inmates.[28] At first (*c.* 1884) he used nine lenses arranged in the lens-panel in a circle. A disk shutter with a single aperture uncovered and covered each lens successively at regular intervals by means of a metronome interposed in the electric circuit. As the usefulness of the pictures was limited by their small size (2 cm. circle), Londe in 1893 constructed a larger apparatus taking pictures 7 cm. × 7 cm. on a plate 24 cm. × 30 cm. This camera had twelve lenses arranged in three rows of four, the shutters being operated by an electro-magnet set off by clockwork.

ELECTRIC FLASH PHOTOGRAPHY

Whilst the previously described methods were efficient for the recording of slow- or medium-speed movements of relatively large objects, a different means was necessary to record the motion of objects which had to be photographed at close range and at speeds exceeding $\frac{1}{5000}$ second. SIR CHARLES WHEATSTONE had indicated a way by which this might be accomplished in a paper he communicated to the Royal Society five years before the introduction of photography.

> The instantaneousness of the light of electricity of high tension affords the means of observing rapidly changing phenomena during a single instant of their continued action, and of making a variety of experiments relating to the motions of bodies when their successive positions follow each other too quickly to be seen under ordinary circumstances. A few obvious instances will at present suffice. A rapidly moving wheel, or a revolving disc on which any object is painted, seems perfectly stationary when illuminated by the explosion of a charged jar. Insects on the wing appear by the same means fixed in the air. Vibrating strings are seen at rest in their deflected positions. A rapid succession of drops of water appearing to the eye as a continuous stream, is seen to be what it really is, not what it ordinarily appears to be, etc.[29]

Some of Wheatstone's electrical demonstrations proved very popular at the Adelaide Gallery, but by the time FOX TALBOT applied photography to one of them, they had apparently been forgotten. This was in June 1851 at the Royal Institution, London. Talbot fastened a page of *The Times* to a wheel which was made to revolve rapidly. The lights in the lecture room were extinguished, the lens of the camera uncapped, and an instantaneous exposure was made by the spark from a battery of Leyden jars. The brilliant flash produced by such a discharge lasts for only $\frac{1}{100,000}$ second or less. The plate was developed on the spot and showed a clear readable image of the printed page. The audience was greatly impressed. Everyone imagined that the success of the experiment depended on the 'highly exalted sensibility' of the albumen plate which Talbot used. In reality, albumen was the slowest negative material he could possibly have chosen. But nobody knew it then, for the albumen process was a French invention hardly known in England. Talbot disclosed his preparation of the plate–not without first having patented it–together with his 'method of obtaining under certain circumstances the photographic picture of objects which are in rapid motion'. Nevertheless he seems to have realized that the success of the experiment depended on the brightness of the flash. 'From this experiment the conclusion is inevitable', wrote Talbot, 'that it is in our power to obtain pictures of all moving objects, no matter in how rapid a motion they may be, provided we have the means of sufficiently illuminating them with a sudden electric flash.'[30]

Talbot laid the foundation of an entire branch of scientific photography. Before the century was out, most of Wheatstone's observations had been recorded by photography, and some others in addition.

In 1887 PROFESSOR ERNST MACH of Prague University and DR P. SALCHER, professor at the naval college at Fiume, succeeded in photographing projectiles moving at approximately 765 miles an hour, and clearly showing the sound waves accompanying their passage through the atmosphere. The projectile was shot at a glass tube containing wires and the contact set off a strong electric spark.[31] Mach's photographs, which are preserved at the Conservatoire des Arts et Métiers, Paris are no bigger than pictorial postage-stamps. About the same period Ottomar Anschütz took at the Krupp artillery range near Essen photographs of projectiles in flight, the shutters of the camera being electrically operated by the projectiles as they passed through an electric circuit. The speed of the projectiles is not known.

PROFESSOR C. V. BOYS, F.R.S., of the Royal College of Science, London, in 1892 extended Mach's experiments with projectiles flying at about twice the speed.[32] An interesting sequence of photographs was taken of a bullet piercing a sheet of plate-glass. One photograph showed the bullet just entering the glass plate, throwing a cloud of glass dust backwards; another was taken after the bullet had passed 5 in. beyond it, and showed the bullet covered with a thick layer of glass dust. A third photograph taken after the missile had passed 15 in. beyond the glass plate showed the bullet quite clear of the glass dust, but one large splinter close to it is seen to be causing air waves on its own account. The remarkable ballistic photographs exhibited by Professor HUBERT SCHARDIN at the World Exhibition of Photography in Lucerne, 1952, show the technical advance that has been made in the twentieth century. It is now possible to take camera photographs of bullets in flight, whereas Mach and Boys only recorded the *shadows* of a bullet and sound waves cast by an electric spark on a photographic plate.

The pioneer work in splash photography of LORD RAYLEIGH, F.R.S., PROFESSOR A. M. WORTHINGTON, F.R.S., and THÉODORE LULLIN also seems forgotten, and the credit in this field is given to HAROLD E. EDGERTON and KENNETH J. GERMESHAUSEN of the

Pl 254

Massachusetts Institute of Technology, whose multiple flash photographs of flying bullets, drops of water, pigeons on the wing, cups breaking, etc., caused widespread astonishment in 1933. Yet high-speed photography at exposures of one-millionth of a second had become familiar to the public in the mid-1890s[33] and is not a development of the twentieth century, though technically the modern pictures are naturally better. Rayleigh and Lullin took amazing photographs of dripping tap water, the latter also the gyrating movement which in the breaking of a continuous jet draws the revolving bubbles around the point of the fall.[34] Rayleigh lectured at the Royal Institution, London, about his electric-spark photography on 6 February 1891.[35] Worthington's series showing a drop of water or a ball falling into milk, producing first a cavity in the surface surrounded by a crown of splashes, then a column of milk rising, resulted in two highly interesting publications.[36]

In the early years of this century PROFESSOR LUCIEN BULL of the Institut Marey was able by the spark method to record the wing oscillations of insects, which were far too rapid to be successfully photographed before.[37]

35 *Documentation*

Social Documentation. In the early 1860s CARLO PONTI made some interesting photographs of picturesque Venetian street characters, not apparently with any documentary intention but for sale as souvenirs to tourists. Unfortunately he posed many of them in the studio though he managed to avoid the artificial impression which such treatment is liable to produce.

JOHN THOMSON, in collaboration with Adolphe Smith, a journalist, produced in the mid-1870s a kind of sequel to Henry Mayhew's social survey *London Labour and the London Poor* (1851). This work was illustrated with woodcuts, some of them copied from RICHARD BEARD's daguerreotypes of street traders, etc., with the background freely sketched in by the engraver. *Street Life in London*, on the other hand, published in 1877, constitutes the first photographic social documentation of any kind. In contrast to Ponti, Thomson's thirty-six photographs show street musicians, an Italian ice-cream seller, men outside a public house, a quack doctor, a locksmith, Pl 257 a shoe-black, a bus conductor, recruiting sergeants, public disinfectors etc. in their natural surroundings. The accompanying articles, some by Thomson and some by Smith, concerned the living and working conditions of the subject. Most moving of all is a very 'modern' study of an old woman who made a bare existence by baby- Pl 255 minding for working women.

Thomson, a Fellow of the Royal Geographical Society, had travelled much in the Orient (see chapter 23) before establishing himself in the 1880s as a portrait photographer in Mayfair, London, where he became renowned for his 'at home' portraits of celebrities.

Almost contemporaneous with Thomson's great documentary on *China and its People* (1873–4), with 200 photographs, was *The People of India*, the first large-scale ethnographical work to be undertaken by photography. The eight volumes, edited by Dr Forbes Watson and Sir John William Kaye and published in London between 1868 and 1875, contain over 450 photographs. Fifteen photographers–all members of the British forces in India–were engaged on this gigantic undertaking, the idea of which originated with the Governor-General of India, Earl Canning, himself a keen amateur.

Pl 256 Between 1868 and 1877 THOMAS ANNAN documented notorious slums for the Glasgow City Improvement Trust. Much of his work goes deeper than the mere recording of a close or alley to be demolished, for the poverty-striken people outside their ramshackle wooden houses are a vivid reminder to society of its obligations towards those who work for it.

A similar intention moved JACOB A. RIIS, a Danish carpenter who, soon after his emigration to America, became a newspaper reporter of police-court cases, first for *The New York Tribune* and later for *The Evening Sun*. This work brought him into contact with the terrible conditions in New York tenements in the 1880s, particularly in Mulberry Bend, a vice-ridden slum. Pls 258, 259 Realizing that horrible housing conditions were the main cause of the crimes he had to report, and convinced that the camera would prove a mightier weapon than the pen against poverty and overcrowding, Riis took up photography in 1887, using flashlight in dark cellars and alleys, and became America's first photo-reporter. In articles, lectures and books[1] Riis awakened the conscience of New Yorkers and won the support of Theodore Roosevelt, then Governor of New York State, who instigated a number of social reforms, including the demolition of Mulberry Bend and the rehousing of its inhabitants. Today the Jacob A. Riis Neighbourhood Settlement commemorates Riis's great work.[2]

LEWIS WICKES HINE, an American sociologist, took up photography in 1905 in order to expose the miserable plight of poor European immigrants after arrival at Ellis Island. Pl 260 Three years later he highlighted the life and work of Pittsburgh iron and steel workers, and then as staff photographer to the National Child Labour Committee he revealed the exploitation of children in factories. His human documents are a terrible indictment of the social injustice of the times, and led to the passing of the Child Labour Law.

DR ARNOLD GENTHE, a portrait photographer in San Francisco in the mid-1890s, made an excellent documentation of the life and customs of Chinatown.[3] Having lost everything in the devastation caused by the earthquake and fire of 1906, Genthe Pl 261 borrowed a camera to record the conditions following the catastrophe and produced a set of pictures which are visually appealing and at the same time valuable historic documents.

PAUL MARTIN may be aptly called the first 'candid cameraman', for although this phrase was coined for DR ERICH SALOMON in 1930, it was Martin who as early as the Pls 263, 264 1890s astonished the public with his unposed street-life pictures of London and his candid snapshots of holiday-makers at the seaside. The people were completely unconscious of being photographed, for Martin's 'Facile' detective camera was concealed in an ordinary-looking bag with a hole just big enough for the lens to poke through.

Martin took up photography as a hobby in 1884 while apprenticed to a London firm of wood-engravers working for newspapers. Knowing the kind of illustrations editors wanted and foreseeing that the photographic half-tone block would eventually supersede the woodcut, Martin started taking photographs in his spare time.[4] In 1900 he established himself as a free-lance press photographer in the Strand.

Paul Martin's London-by-night pictures taken in the winter of 1895–6 were a subject not previously attempted. He chose wet evenings at twilight, so as to obtain light reflections from the pavement and a shadowy outline of buildings, giving an exposure of 10–15 minutes at F.8. Halation was avoided by using backed isochromatic plates and by covering the lens with his hand whenever the lights of a cab came into view.[5]

Street-life pictures similar to Martin's were taken in the 1890s by a number of amateurs including T. C. HEPWORTH of London,[6] MRS E. A. AUSTEN, an amateur in New York, MAURICE BUCQUET, President of the Photo-Club de Paris, and–a few years later–by EUGÈNE ATGET.

Living London[7] was a social documentation on a much more ambitious scale than Thomson's, though the dry plate had made the task considerably easier. The majority of the over 1,200 photographs in this monumental work are unfortunately not acknowledged. A few are by Frederick York, Spencer, and some are in the style of Paul Martin. This book demonstrates the astonishingly wide range of subjects which photographers tackled successfully nearly seventy years ago–the kind of pictures that one nowadays associates with the reportages taken in the 1930s by Bill Brandt, Brassai, and Felix H. Man and other photographers working for illustrated weeklies.

Much excellent amateur work is only beginning to come to light. COUNT GIUSEPPE PRIMOLI chronicled Roman life both high and low between 1885 and 1905 with admirable directness and originality of vision. Similar qualities distinguish the pictures of JACQUES HENRI LARTIGUE, who as a boy in the first decade of the twentieth century took fascinating snapshots of early motoring and flying, and of fashionable ladies in the Bois de Boulogne and at the races.[8]

NAHUM LUBOSHEZ, a Russian by birth and Kodak's representative in St Petersburg before the First World War, took some striking pictures of life in Russia. Pl 262

After the establishment of the Photographic Survey of Warwickshire in 1889 there was much talk of forming a National Photographic Record and Survey, both of which W. JEROME HARRISON proposed. In 1895 Léon Vidal, head of the Musée des Photographies Documentaires, reported to a conference in London on the work of the French organization, but it took another two years until the National Photographic Record Association came into existence, chiefly through the untiring efforts of SIR BENJAMIN STONE, M.P., who combined with equal enthusiasm the position of president and chief photographer.

Stone was the apostle of photography as a recording medium. A wealthy businessman, he was led to take up photography as a result of the difficulty he found in obtaining photographs of the subjects he collected: the manners and customs of the English, picturesque festivals and pageants, and curious ceremonies which were slowly dying Pl 265 out. This documentation the Association was formed to undertake, and in order to leave to posterity a permanent pictorial record of contemporary life, it was stipulated that all photographs should be printed in one of the permanent positive processes such as carbon or platinotype, and that $8\frac{1}{2}$ in. × $6\frac{1}{2}$ in. should be the standard size. The records were from time to time deposited in the Department of Prints at the British Museum (where they still are)–a circumstance due, no doubt, to the fact that the Director of the British Museum was a member of the Association.

Stone's position as Member of Parliament for Birmingham enabled him to photograph the House in detail and to take portraits of the Cabinet Ministers, Members of Parliament, and other officials. He also recorded the many customs and state functions connected with parliamentary life. His sitters were said to range from the Prime Minister to a beggar, and his subjects from palaces to dungeons. No scene, no building, no object, no person, baffled him. Photography was to him not a hobby but a passion. He enjoyed many privileges denied to others, and so it came about that his request for permission to photograph the Coronation of King George V in Westminster Abbey was granted.

About 1910 the Association was dissolved, chiefly on account of the apathy of its members, about which its keen President more than once bitterly complained. He himself added continually to this collection of documentary photographs, and at the time of his death in July 1914 it was stated that altogether some 6,000 photographs had been presented to the British Museum. Stone's own fabulous collection of 22,000 photographs, including 14,000 negatives, was bequeathed to the Birmingham Reference Library. He had published a selection of the most interesting subjects about 1905.[9]

EUGÈNE ATGET had been for fifteen years an unsuccessful actor touring the French provinces when he settled in Montparnasse in 1899 and took up photography. Until his death twenty-eight years later Atget devoted himself with immense enthusiasm to the documentation of Paris. But whereas others extolled the grandeur of the great capital, Atget's interest inclined towards documenting the unattractive and even the seamy side of life in the metropolis. He has been wrongly considered the father of modern social documentation, in ignorance of earlier workers. This aspect of his work has been over-emphasized,[10] to the almost complete exclusion of everything else, and thus a distorted impression has gained ground. Atget recorded everything of interest in a Paris that was vanishing. His pictures include every kind of street trader from an umbrella seller to a prostitute, every kind of Parisian vehicle Pl 266 from a baker's barrow to a cab, a great variety of shop displays (usually in the poorer districts), *petit bourgeois* interiors, the narrow streets of Montmartre and the Quartier Latin, porticos, staircases, doorknockers, wrought-iron grilles, and ornate stucco decorations of houses which had seen better days–they all fascinated Eugène Atget's roving eye. Religious art–statuary and church interiors–attracted him as much as the gaudy and fantastic decorations of shop signs and merry-go-rounds, or the un- Pl 267 usual forms and patterns of flowers and gnarled tree roots of which he took countless close-ups. And when, after taking hundreds of photographs, he had exhausted all the possibilities of each of these subjects, he took views of the beautiful gardens and statues of the Palais du Luxembourg, of Versailles, Fontainebleau, and St Cloud.

Details appealed to Atget above all, and a large proportion of his photographs are close-ups. He saw the poetry in everyday subjects which other people pass over as nothing remarkable, or, as William Blake wrote:

To see a world in a grain of sand
And a Heaven in a wild flower,
Hold infinity in the palm of your hand,
And eternity in an hour. . . . .

Eugène Atget was known to few people, though his photographs were sometimes bought by leading artists including Utrillo, Vlaminck, Braque, de Segonzac and Derain, and by tradesmen whose shop-fronts he photographed. He charged five francs for 18 cm. × 24 cm. positives on albumen paper, which were printed by his wife. He was very modest, and only a man with tremendous faith in his work could have pursued his path so single-mindedly with so little encouragement. When Atget died in great poverty he left nearly 10,000 albumen prints, all contact copies from 18 cm. × 24 cm. plates, carefully titled and filed. Many of these were acquired by the American photographer BERENICE ABBOTT. Most of his negatives were bought by the Archives de Documentations Photographiques at the Palais Royal for a mere song.

Despite several small books with Atget's pictures[11] there is still no adequate monograph on this important photographer, who influenced among others BRASSAI and BILL BRANDT.

Exploration. Like his father GIUSEPPE SELLA, who wrote the first general handbook on photography to be published in Italy (1856) and was a famous alpinist after whom a big group in the Dolomites is named, VITTORIO SELLA combined photography with climbing. From 1880 onward his exploits in the Alps, the Caucasus, Alaska (1897), Equatorial Africa (the Mountains of the Moon; 1906) and the Himalayas (1909), mostly as official photographer to the Duke of Abruzzi's expeditions, made Sella's photographs world-famous. Many of these climbs established altitude records.

Sella did not, of course, at that late date have to contend with the great difficulties of wet collodion.

Photographs taken by the Swede SALOMON AUGUST ANDRÉE during his disastrous attempt to reach the North Pole by balloon in 1897 were recovered from the ice thirty-three years later and successfully developed. They told a graphic story of the tragedy that befell Andrée and his two companions.

HERBERT PONTING, official photographer to Captain Scott's second and last South Pole exploration (1910-12), brought back a superb record of the ill-fated expedition Pl 268 and the magnificent Antarctic landscape, a selection of which he later published in his well-known book *The Great White South*.

Similar splendid documentations were made by CAPTAIN FRANK HURLEY, an Australian, on no fewer than five Antarctic expeditions which demanded great resourcefulness. The crushing of the *Endurance* by ice and the rescue of the party six months later was recorded by Hurley in highly dramatic pictures on Sir Ernest Shackleton's second Antarctic expedition of 1914–16. They express better than words the hardships endured.

36 *Press photography*

There was no demand for press photography until the half-tone block made possible the reproduction of photographs together with the text in newspapers and magazines. The feasibility of printing a photo-block alongside type had been successfully demonstrated by STEPHEN H. HORGAN in the New York *Daily Graphic* in March 1880 and by GEORG MEISENBACH of Munich in the *Leipziger Illustrierte* in October 1883, but with two exceptions newspapers everywhere resisted, for forty-five years and more, changes in organization and processing plant which the use of photographs would have necessitated. Even then some preferred to follow the example of the *New York Times* (6 September 1896) and issue a weekend photographic supplement. The first newspaper to adapt itself to modern conditions was the *Daily Mirror*, London, which had started publication on 2 November 1903 and with its issue of 7 January 1904 became the world's first daily newspaper to be illustrated exclusively with photographs. For once, the usually progressive Americans lagged behind the British, for over fifteen years passed by before the *Illustrated Daily News*, a New York tabloid, followed suit in June 1919.

News photographs have to be topical, but until newspapers had their own staff-photographers with processing facilities on the premises, and their own departments for making photo-blocks, the supply of these by outside firms and the timing for the final layout was too uncertain.

Weekly and monthly magazines, on the other hand, which had ample time for preparation, used photographs extensively from the mid-1890s onward. The position is very similar today with regard to colour photographs, which are a big feature in magazines, but hardly ever printed in newspapers, although the *possibility* of their inclusion is not in question.

The leading illustrated weeklies that came into existence a few years after the invention of photography – *The Illustrated London News*, London, on 14 May 1842; *L'Illustration*, Paris, on 4 March 1843, and *Die Illustrierte Zeitung*, Leipzig, on 1 July 1843 – used photographs of celebrities, of topical events and historic occasions extensively, but until the early years of the twentieth century they served, with few exceptions, as copy for woodcuts. This handful of weeklies and a few monthly magazines bought their illustrations from outside sources, and not infrequently commissioned a picture to be taken, but it was not an outlet on which a photographer could have relied for his living. But whilst photography for the press did not come into being until the Edwardian era, topical news events had been recorded from the moment the photographic material was sufficiently sensitive (see chapter 22).

Of the numerous examples towards the close of the nineteenth and at the beginning of the twentieth century, only a few events can be cited: the Dreyfus affair (1894–1906), the opening of the Kiel Canal by Kaiser Wilhelm II (1895), the Klondike gold rush and the Spanish/American War (1898), the Boxer Rebellion (1899–1901), the Boer War (1899–1902), the Russo-Japanese War (1904–5), and other specific events such as the funerals of Victor Hugo (1885) and Verdi (1901), Blériot's cross-Channel flight (1909), the assassination attempt following the wedding of King Alfonso XIII of Spain (1906), numerous state visits, inaugurations of monuments, and the event that sparked off the First World War. Pl 274

Gladstone's whistle-stop speech at Warrington station in 1885 was a news event Pl 271 recorded by J. BIRTLES. This electioneering technique, adopted in modern times by American presidential candidates, annoyed Queen Victoria very much, and led a wag to write:

I'm an old Parliamentary hand,
I'm gay and I'm fresh as a flower,
And I travel express, so of course you will guess
I soon shall get back into power.

A large proportion of the news pictures were taken by amateurs who happened to be on the scene, as, for example, the photograph of H.M.S. *Victoria*, flagship of the Pl 270 British Mediterranean fleet, sinking after being in collision with H.M.S. *Camperdown* off Tripoli on 22 June 1893. News pictures were sold as photographic prints or stereoscopic slides by printsellers, or as postcards issued either by the photographer or, after 1901, by the Rotary Photographic Company, which specialized in the publication of postcards of celebrities, especially stage people, and historic occasions. Paul Martin relates[1] that his first important news photographs, of Queen Victoria's funeral in 1901, were not published, but sold through a printseller. The following year, his photographs of reviews and other ceremonies connected with King Edward VII's coronation were placed with newspapers and copied as woodcuts. Photographs of accidents, a murderer leaving court, sporting and social functions, and other subjects of the kind so frequently seen in newspapers today, were only rarely published.

The first photo-interview for the press took place in August 1886. That summer PAUL NADAR, son of the portrait photographer, was asked by *Le Journal Illustré* to take a number of photographs in different poses of the famous chemist Michel Pl 269 Eugène Chevreul on the occasion of his hundredth birthday. Paul Nadar would have liked to use a phonograph to record the voice of the centenarian,[2] but not having one, a stenographer took down Chevreul's replies to questions. Chevreul granted three interviews, one at his home and the others at Nadar's studio, opening the proceedings with the cheerful remark: 'I was an enemy of photography until ~~by~~ my ninety-seventh year, but three years ago I capitulated.' While Nadar *père* asked the questions, Paul Nadar recorded Chevreul's animated expressions and gestures in over a hundred photographs taken in fairly rapid succession with a camera fitted with an Eastman/Walker roller-slide. (He had just become Eastman's agent for France.) The exposure time was stated as $\frac{1}{133}$ second, using Thury & Amey's instantaneous shutter.[3] Thirteen of the pictures were published as half-tone blocks in *Le Journal Illustré* on 5 September 1886, with Chevreul's lively answers as captions. The photo-interview aroused extraordinary interest and by evening copies of this 15-centime paper were changing hands for five francs.

There is a curious discrepancy between the amusing published captions 'On the Art of Living a Hundred Years' and some of those in a Nadar album at George

Eastman House, in which the text is largely concerned with Chevreul's colour theory. As he is shown spinning a colour-disk to demonstrate his theory, the latter version is evidently the correct one.

Three years later the two Nadars photo-interviewed General Boulanger for *Le Figaro*, but–whether for reasons of expense or otherwise–this kind of feature did not catch on for forty years.

Not for the press but for a book publication[4] the author-photographer W. B. NORTHROP in 1903 interviewed a number of distinguished people, and illustrated his pen-portraits usually with two photographs showing the subject in action in his normal surroundings. They were very much on the lines of ELLIOTT & FRY's portrait Pl 272 of Sir Joseph Wilson Swan taken in his laboratory the same year. Today's portrait profiles in the Sunday papers are a continuation of this tradition.

RHEINHOLD THIELE, a German active in London as a portrait photographer and press photographer, recorded naval manœuvres, boat-races, balloon ascents, Diamond Jubilee reviews, and a host of other functions for illustrated monthly and weekly magazines. Most of his work was done for *The Graphic*, which on the outbreak Pl 273 of the Boer War sent Thiele to South Africa. His photographs appeared as woodcuts in that paper, and after his return Thiele issued photographic prints of 611 subjects, taken with a 10 in. × 8 in. camera. He also sold prints of the photographs taken by HARFORD HARTLAND, who had followed the Natal campaign for *The Navy and Army Illustrated*. In addition, hundreds of photographs were taken for the American publishers of stereoscopic pictures, Underwood & Underwood, whose (unnamed) staff photographers covered the Boer War, the Russo-Japanese War, and Pl 276 events such as President Theodore Roosevelt's inaugural address in front of the Capitol in Washington in 1905.

(Incidentally, the Boer War was the first to be recorded by cinematography. An amateur, JOHN BENNETT STANFORD, sent home the first films, which aroused great enthusiasm when shown at the Alhambra Theatre, London. Soon after, the Warwick Trading Company, then the leading British film company, sent out three cameramen: JOSEPH ROSENTHAL, EDGAR M. HYMAN, and later SIDNEY GOLDMAN. Better known than these is W. K. L. DICKSON of the British Mutoscope & Biograph Company, on account of his book *The Biograph in Battle*, London, 1901.)

MRS ALBERT BROOM was probably the first woman press photographer. Teaching herself photography at the age of forty with a little box camera, she remained a freelance photographer to the end of her life, publishing her photographs as postcards, and sometimes also in newspapers. Having taken some photographs of the Scots Guards' sports, she sent them to the Colonel of the regiment, who liked them so much that he asked her to take some of the Guard mountings. This was Christina Broom's introduction to the army, through which she became photographer to the Household Brigade, the Royal Mews at Buckingham Palace and Windsor; she also photographed the royal family on special occasions. Mrs Broom was a woman of determined character; it cannot have been easy in those days for a woman to photograph military reviews and to push her way with her stand camera through crowds Pl 277 on such occasions as suffragette and other political meetings, Edward VII's funeral, and George V's coronation. She also took many pictures of military leaders and life in London during the First World War.

The first press agency, the short-lived Illustrated Journals Photographic Supply Co. in Ludgate Hill, was founded early in 1894. The proprietors stated that they had made arrangements with photographers in every part of the country, enabling them to secure any photograph not in stock within 24 hours, and in particularly important cases, in 6 to 12 hours. This was a comparatively fast service, but not fast enough for the new century. Another nine years, and the motor car was past the stage of being a mechanical horse for ladies and gentlemen. A remarkable forecast appeared in 1903.

> Why does not some press photographer apply the motor car to his business? The car to be fitted up as a small dark room: the top to serve as a standpoint for the camera, and to carry flashlight installation for photographing street scenes. The press photographer will be telephonically next door to the newspaper editors, and the new order of things may be forecasted thus:
>
> 2.30 *Editor* (the Daily Biograph). Hullo! You 4160 Central?
> *Speed & Co.* Yes, we're Speed & Cô.
> *Editor D. B.* Railway smash at Croydon. Fifty reported killed. Photograph at once.
> 2.32 to 3. Speed & Co. *en route* to Croydon.
> 3 to 3.15. Speed & Co. photograph scene of accident.
> 3.15 to 3.30. Speed & Co. *en route* from Croydon to Fleet Street. Deliver glossy bromide prints from negatives developed *en route*.
>
> Impracticable, is it? My opinion is that press photography must develop in these directions.[5]

The Illustrated Journals Photographic Supply Co. was followed by the Illustrated Press Bureau Ltd, set up in Arundel Street, Strand, in 1899, and the World's Graphic Press Agency, also in London, which JAMES JARCHÉ joined in 1907. Other early press photographers in England were THOMAS BOLAS and F. W. MILLS. They worked anonymously as is still the custom with press agency photographers. In the United States the New York firm of UNDERWOOD & UNDERWOOD, then the world's largest publishers of stereographs, in 1896 began to supply newspapers and magazines with news photographs.

Some press cameras. Though most magazine, roll-film and reflex cameras of the type described in chapter 31 served perfectly well for press photography in those days, some specialized equipment came on the market, and three cameras should be briefly described. The first, and for many years best known, on the Continent was the camera patented by OTTOMAR ANSCHÜTZ in 1888 and manufactured by Carl Paul Goerz of Berlin-Friedenau. The Goerz/Anschütz camera was fitted with a focal-plane shutter and, from 1893 on, a Dagor lens (F.7·7), the first double anastigmat, designed by E. von Hoegh. The 9 cm. × 12 cm. folding camera, which was originally designed by Anschütz specifically for recording the movement of storks in flight and of horses (see chapter 34), eventually became popular as a handy press camera because of the very short exposure times (down to $\frac{1}{1000}$ second) that could be achieved with the focal-plane shutter, and the frame view-finder for taking pictures at eye-level.

The 'Spido' camera introduced in 1900 by L. Gaumont & Cie., Paris, had a Zeiss F.8 anastigmat lens of 13·5 cm. focal length, a pneumatic shutter and a frame view-finder. It too was a 9 cm. × 12 cm. camera, to which exchangeable magazines for twelve plates, with automatic counter, were attached.

The Contessa 'Nettel' brought on the market by the Contessa Works, Stuttgart, about 1903, was a light-weight wooden folding camera for 9 cm. × 12 cm. plates, with a Zeiss F.8 anastigmat lens of 13·5 cm. focal length, and a focal-plane shutter.

37 *Naturalistic photography*

In chapter 19 we have spoken of the strenuous efforts of a few to raise photography to the status of a fine art with their ambitious compositions. The pursuit of this phantom filled exhibitions with many banalities on a par with those exhibited at the Royal Academy at the time. In the 1870s and 1880s there was a dearth of artistic photography, and the little that existed was dominated by H. P. Robinson until a new school of landscape photography came to the fore. To re-animate photography, DR PETER HENRY EMERSON, a keen amateur since 1882, called for a return to nature–as the Barbizon School and Courbet had done a generation earlier in painting. 'Whenever the artist has been true to Nature, art has been good; whenever the artist has neglected Nature and followed his imagination, there has resulted bad art. Nature, then, should be the artist's standard.' This was Emerson's anti-romantic Credo, laid down in his book *Naturalistic Photography* (1889). Emerson convincingly demonstrated in seven beautifully illustrated books on the Norfolk Broads–his favourite subject–that by selection, view-point, and rendering of atmosphere, a photographer can imbue ordinary subjects with artistic quality bearing a personal stamp; consequently there was no need to resort to the artifices of the High Art photographers.

With sensitive feeling, Emerson rendered at all seasons of the year the atmospheric conditions of this low-lying land intersected with rivers and lakes. An admirer of J. F. Millet, who devoted his life to portraying the work of peasants at Barbizon, Emerson depicted with similar insight and sympathy the simple life of the Fenland
Pls 278, 279 people, setting and taking up their fishing nets, shooting duck and snipe, gathering reeds, ploughing and harvesting. *Life and Landscape of the Norfolk Broads* (1886), the finest and rarest of Emerson's illustrated books, which were all published in limited *de luxe* editions, contains original platinum prints; his subsequent books were illustrated with photogravures or photo-etchings, which Emerson considered more artistic in giving a broader, softer rendering.

In contrast to the landscape photographers of the 1850s and 1860s, whose aim had been a picture of all-over sharpness, Emerson advocated a certain degree of softness in the negative through differential focusing, by which the principal subject of the picture was sharp and the remainder less so. Differential focusing, claimed Emerson, enabled the naturalistic photographer to give a truer rendering of nature than the realistic photographer who wanted precision and all-over sharpness, i.e. the naturalis-
Pl 278 tic photographer would, as in the example reproduced, focus on the main subject of the picture–the boat and its occupants–letting the sharpness fall off in the foreground and particularly in the background. The realistic photographer would also focus on the main subject, but would stop down the diaphragm to such an extent that the

whole of the picture would be pin-sharp. This is not natural, for we see only one part of a view sharp, but unconsciously we alter the eyes' focus all the time very rapidly, and appear to see the whole view sharp at once.

However, one should not lay down the law on such matters, for the creative photographer will employ whatever method is best suited to his interpretation of the particular subject. In spite of Emerson's wordy expositions of naturalistic photography, it is difficult to detect much difference in focusing technique between the fine realist landscapes of the first generation of photographers and his own. It was, however, not so much Emerson's theories that aroused the antagonism of the older generation at the Photographic Society as his constant stream of invective against all who did not agree with him. He rightly condemned composite photography, then still practised by H. P. Robinson in spite of fast gelatine dry plates which rendered this photo-montage work quite unnecessary for well-lit outdoor scenes such as his 'Carolling' (1887), in which two girls and a flock of sheep are printed into the landscape.

It was said that Emerson's book *Naturalistic Photography* 'burst like a bombshell in the midst of a tea party'. The old-fashioned toilers with scissors and paste-pot found their artificial picture-making superseded by the younger adherents to Emerson's naturalistic photography. The most prominent of these were the amateurs GEORGE DAVISON, a civil servant, A. HORSLEY HINTON, editor of *The Amateur Photographer*, COLONEL JOSEPH GALE, BENJAMIN GAY WILKINSON, a solicitor, J. B. B. WELLINGTON, a manufacturer, LYDDELL SAWYER and FRANK M. SUTCLIFFE, the last two professional portraitists in the provinces. Their work is discussed and illustrated in W. Arthur Boord's fine volume *Sun Artists* (1891). Pls 280, 281

Meanwhile the amateur movement gained momentum, and a marked division appeared between the mass of snapshooters and those who sought to advance photography as an art. The constantly increasing number of–chiefly uneducated–photographers who, attracted by the new facility of manipulation, competed with established professionals, lowered the status as well as the standards of photography. 'The evidence is clear enough', wrote Emerson, 'that had the artists and scientists who were the promoters of the first English Photographic Society held their own, photography today would probably have been practised by artists and scientists alone–a noble and learned profession–instead of being practised, as is now only too often the case, by illiterate and ignorant tradesmen.'[1]

To demonstrate that a gulf separated them from snapshooters and commercial photographers, pictorial photographers unfortunately adopted means as alien to the photographic medium as were the artificialities of the old school they were trying to combat. Whereas 'fine art' advocates were led to produce imitation paintings representing subjects only suited to graphic art, several of the 'naturalistic' school came under the spell of the impressionist style.

The 'naturalistic' movement towards impressionistic photography was started by a letter from Emerson to *The Photographic News* early in May 1889, urging all interested in art to see the works of impressionist painters, then on view in London. Using the term 'Impressionism' in its broadest sense, Emerson enumerated the works of Monet, Corot, Millet, and Maris, and Sargent's portrait of Ellen Terry. A great admirer of Julia Margaret Cameron's work, Emerson had become an advocate of differential focusing to achieve soft outlines, and the exhibition of the works of these painters added force to his argument. Before long the fierce controversy, sharp versus soft focus, which had caused a great deal of dissension on previous occasions, was revived with renewed passion.

Soft focus, or impressionistic rendering, was by no means new in photography. Long before, in 1845, SIR DAVID BREWSTER had advocated diffusion of focus in a paper to the British Association in which he described a method of 'producing very soft and agreeable positive pictures by inserting sheets of paper or a sheet of glass between negative and print'. Considering that the chief characteristic of calotype pictures was their broad soft effect, Brewster's proposal is difficult to understand, and his only follower seems to have been Claudet, who was at that time taking calotype portraits professionally. Claudet explained later that he diffused the image by photographing through a thick sheet of glass, or by placing pieces of ground glass of various degrees of fineness in front of the paper in the camera.[2] The public, used to the minute rendering of daguerreotype pictures, was not impressed by diffused portraits and the experiment was abandoned.

Eight years later the miniature painter SIR WILLIAM NEWTON, R.A., reintroduced the subject at the first meeting of the Photographic Society. His paper 'Upon photography in an artistic view, and its relations to the arts'[3] startled the members by the unorthodox idea that 'the whole subject might be a little *out of focus*, thereby giving a greater breadth of effect and consequently more *suggestive* of the true character of Nature'. Though a storm of protest from the Council and members induced Newton to modify his heretical opinions, the feeling was gaining ground that 'the chemical and optical means of producing photographic images have been brought to greater perfection than the artist requires', and that broad masses of light and shade would indicate a subject sufficiently well and leave some play for imagination. To achieve impressionistic results it was proposed to construct intentionally defective lenses with which detail could be obliterated to any desired extent.[4]

MRS CAMERON's large studies, shown in the exhibitions of 1864 and 1865, gave renewed encouragement to the soft focus advocates, and, indeed, the impressionists in the nineties regarded her as 'the founder of the naturalistic school of photography'. But nothing could have been farther from the truth. The softness of some of Mrs Cameron's early portraits was partly due to careless focusing, as she herself explained in *Annals of My Glass-house*, and partly due to the chromatic aberration of her lens.[5] In her later work, the focusing might be called differential–sharp in the parts on which she focused, and rapidly falling off in the receding parts of the picture, but there was no intentional softness, the wonderfully plastic effect of Mrs Cameron's portraits was due to the long focal length of her lens (30 in.) which forced her to work at open aperture in order to arrive at exposures of a manageable length. (Even then, most of her sitters found the exposures unbearably long.) Art critics praised Mrs Cameron's work with enthusiasm, but for qualities depending on the mind, not on optics.

In the vain belief that the plastic effect of her pictures could be artificially imitated, ANTOINE CLAUDET and the lens-maker JOHN HENRY DALLMEYER introduced differential focusing in 1866. Claudet explained his method of altering the focus during the exposure before the British Association in September 1866, whilst Dallmeyer's paper on his new portrait lens was brought before the Photographic Society of London the following month. Yet despite their efforts, and Brewster's reiteration that 'sharp definition is an evil' and that 'beauty, either of form or expression, is injured by sharpness of outline', the soft focus enthusiasts did not gain ground until the Impressionist painters had renounced objectivity and realistic representation, and made the public accustomed to indefinite contours.

The chief exponent and advocate of impressionism in photography was GEORGE DAVISON, a civil servant and from 1898 managing director of Kodak Ltd. Davison aspired to produce such a rendering of nature as would be given by an Impressionist working in monochrome. In a lecture at the Society of Arts in 1890[6] he inveighed against the clear sharp pictures full of minute detail which were still considered the *ne plus ultra* of photographic art, and his picture 'The Onion Field'–first exhibited in Pl 283 the autumn of 1890 under the title 'An Old Farmstead'–seemed like a declaration of war on the old school. Critics were divided in their opinion. Some, like *The Times* correspondent, spoke highly of its wonderful atmospheric effect 'when looked at from a suitable distance', but the majority sat on the fence.

> If it be that the quality of a photograph is that it should look as unlike a photograph as possible, then Mr Davison has succeeded admirably. . . . It is not very clear what the mass of growth in the foreground is intended to be. If the field of stalks with the knobs at the ends suggests the onion plant, then the object of the picture is answered. . . . It would seem that such photographs as 'The Old Farmstead' can scarcely be criticised on the principles which have hitherto governed photographic art criticism; and it may be necessary to wait until further examples familiarise one with the intentions of the exponents of the new style.[7]

It is paradoxical that at a time when the most perfect lens to date, the anastigmat, had just been introduced, Davison should dispense with a lens altogether and use instead a piece of sheet-metal pierced with a small hole–i.e. a primitive camera obscura arrangement. Excessive diffusion of focus and flat, low tones, to give the photograph something of the effect of an impressionist painting, was, of course, only yet another way of perverting photography in imitation of painting–throwing away the substance for the shadow. An impressionistic photograph did not really deceive anyone; it looked at best like a monochrome reproduction of a painting. But whenever photographs resemble contemporary art, they obscure the critical faculty of art critics, who are quite incapable of judging photographs for their photographic qualities. The exquisite little picture 'Sand Dunes' by B. Gay Wilkinson shown in the Pl 282 same exhibition treated the subject honestly and with more genuine artistry than Davison's painterly 'Old Farmstead' but scarcely drew any notice from reviewers.

Photographic impressionism aroused fierce and loud controversy, just as Impressionistic painting had done before. As is often the case in disputes about art, this was waged with acrimony. Naturalistic and impressionistic photography (regarded by some as one and the same thing) rapidly won new adherents. The more dramatic was the renunciation in December 1890 of 'Naturalistic Photography' by its founder. In a black-bordered pamphlet (Emerson always loved theatrical gestures) *The Death* Fig 65 *of Naturalistic Photography* was announced.

However, the reasons put forward by Emerson for his *volte-face* were not convincing; these included a conversation with an artist in Paris, recent researches in psychology, Hurter's and Driffield's work on photo-sensitometry, an exhibition of Hôkusai's pictures, and study of the paintings in the National Gallery. Everyone knew that he strongly disapproved of Davison's extremist views. The revolution which Emerson had started began to get out of hand as it gathered momentum, and since his conceit was hurt by Davison's assumption of leadership, Emerson's renunciation was largely the outcome of violent egotism and offended vanity. If *Naturalistic Photography* had been confused in its arguments, its renunciation was no less so. With the same fervour with which he had built up exaggerated art claims for photography only two years before, Emerson now denounced it as 'the lowest of all arts' and as 'a handmaiden to science and art'. Had he grasped the true aims and limitations of photography, much of his book and the whole of his recantation need never have

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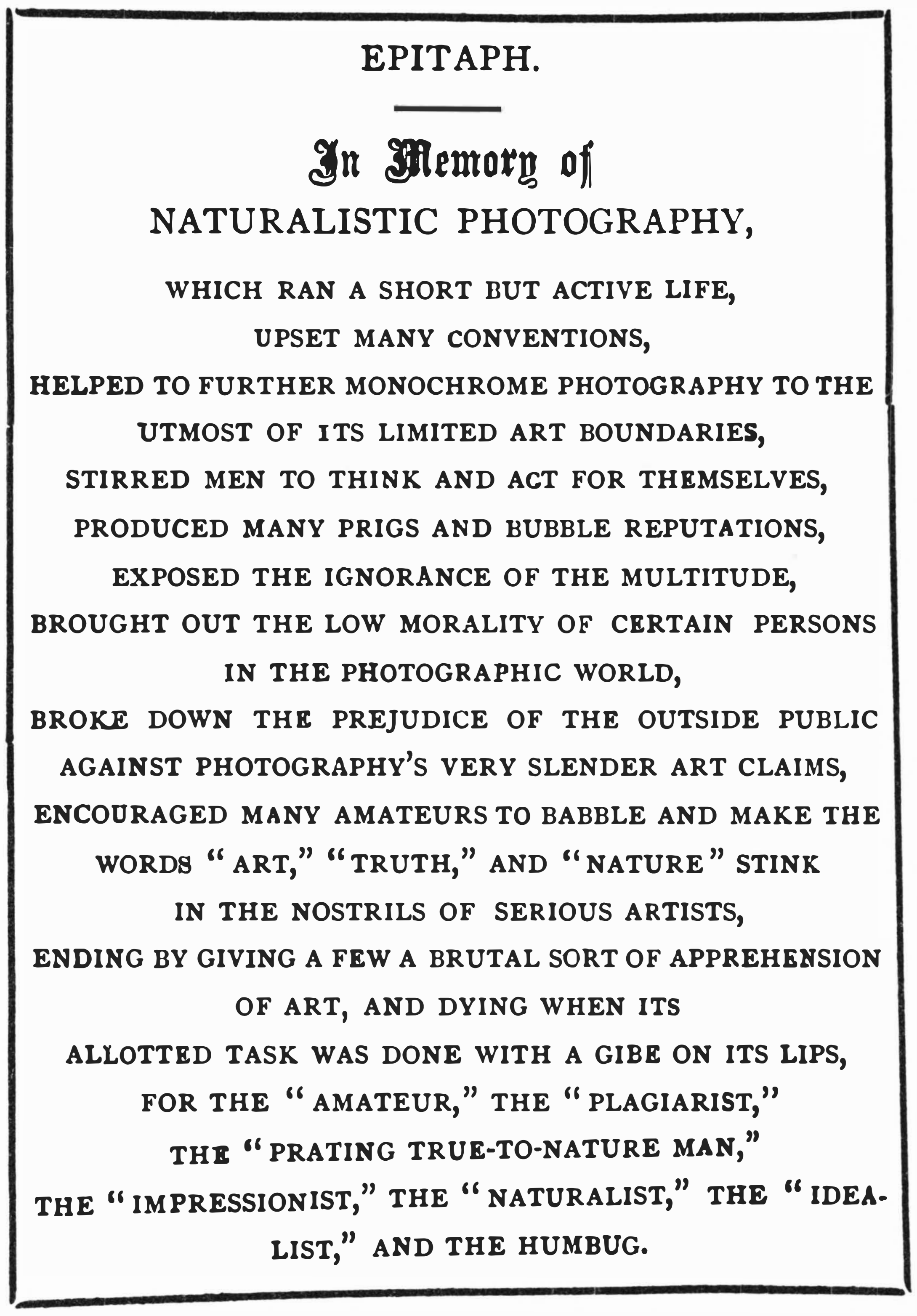
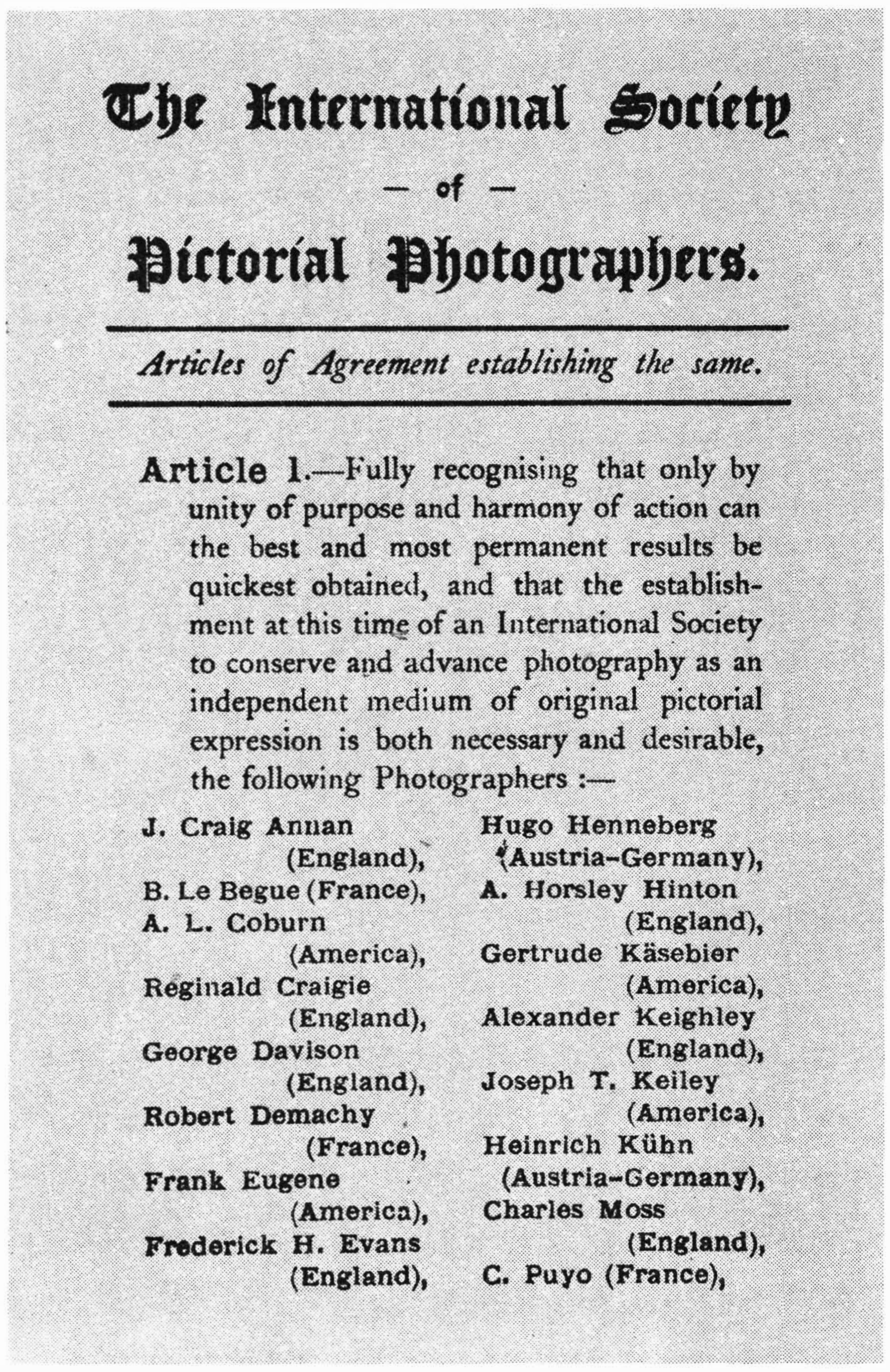


EPITAPH.

In Memory of
NATURALISTIC PHOTOGRAPHY,
WHICH RAN A SHORT BUT ACTIVE LIFE,
UPSET MANY CONVENTIONS,
HELPED TO FURTHER MONOCHROME PHOTOGRAPHY TO THE UTMOST OF ITS LIMITED ART BOUNDARIES,
STIRRED MEN TO THINK AND ACT FOR THEMSELVES,
PRODUCED MANY PRIGS AND BUBBLE REPUTATIONS,
EXPOSED THE IGNORANCE OF THE MULTITUDE,
BROUGHT OUT THE LOW MORALITY OF CERTAIN PERSONS IN THE PHOTOGRAPHIC WORLD,
BROKE DOWN THE PREJUDICE OF THE OUTSIDE PUBLIC AGAINST PHOTOGRAPHY'S VERY SLENDER ART CLAIMS,
ENCOURAGED MANY AMATEURS TO BABBLE AND MAKE THE WORDS "ART," "TRUTH," AND "NATURE" STINK IN THE NOSTRILS OF SERIOUS ARTISTS,
ENDING BY GIVING A FEW A BRUTAL SORT OF APPREHENSION OF ART, AND DYING WHEN ITS ALLOTTED TASK WAS DONE WITH A GIBE ON ITS LIPS,
FOR THE "AMATEUR," THE "PLAGIARIST,"
THE "PRATING TRUE-TO-NATURE MAN,"
THE "IMPRESSIONIST," THE "NATURALIST," THE "IDEALIST," AND THE HUMBUG.

Fig 65 Emerson's 'Epitaph in Memory of Naturalistic Photography', 1890



The International Society
— of —
Pictorial Photographers.

Articles of Agreement establishing the same.

Article 1.—Fully recognising that only by unity of purpose and harmony of action can the best and most permanent results be quickest obtained, and that the establishment at this time of an International Society to conserve and advance photography as an independent medium of original pictorial expression is both necessary and desirable, the following Photographers :—

J. Craig Annan (England),
B. Le Begue (France),
A. L. Coburn (America),
Reginald Craigie (England),
George Davison (England),
Robert Demachy (France),
Frank Eugene (America),
Frederick H. Evans (England),
Hugo Henneberg (Austria-Germany),
A. Horsley Hinton (England),
Gertrude Käsebier (America),
Alexander Keighley (England),
Joseph T. Keiley (America),
Heinrich Kühn (Austria-Germany),
Charles Moss (England),
C. Puyo (France),

Fig 66 Brochure of the International Society of Pictorial Photographers, 1904

been written. Like all unbalanced characters he felt the need to reassure himself and others of his stability.

> I, saner than ever, renounce and abjure all theories, teachings and views on art written and first promulgated by me in sundry works, articles, etc., and finally collected in a volume entitled *Naturalistic Photography*. I cast them upon the dust heap. I am for the present and future neither idealist, realist, naturalist, nor impressionist–*photographic impressionist*, indeed!–a term consecrated to charlatans and especially to photographic imposters, pickpockets, parasites, and vanity-intoxicated amateurs. [These epithets were aimed at George Davison.]

After this violent outburst, the prodigal returned to the Photographic Society–and to the old pictorialists who not long before had been the target of his diatribes. His suggestion that a royal charter would lift the Society from its financial straits proved correct, and in due course his services to the art of photography were rewarded with the Progress Medal (1895) of the Royal Photographic Society. Emerson now withdrew more and more from photography, and with characteristic energy threw himself into new fields of activity, such as rowing and horticulture, in which he won many prizes. He also wrote several non-photographic books. Photography had lost one of its ablest exponents, though many drew a sigh of relief at his departure.

THE LINKED RING

Meanwhile in May 1892 ALFRED MASKELL, together with fourteen more of the younger pictorialists, had broken away from the Photographic Society and formed a group called 'The Linked Ring Brotherhood'. It was one of many secessions that occurred in the 1890s, in painting as well as in photography. The Linked Ring included all the members of the Naturalistic School–except its founder, ALEXANDER KEIGHLEY, and, rather incongruously, the old-fashioned pictorialist H. P. ROBINSON. During the next few years several other photographers joined, of whom the following became prominent: J. CRAIG ANNAN, H. H. H. CAMERON, FREDERICK H. EVANS and FREDERICK HOLLYER.

JAMES CRAIG ANNAN, who introduced photogravure into Britain in 1883, was a great admirer of Whistler and a close friend of the etcher (Sir) David Young Cameron. It is therefore not surprising that Annan's best work is in photogravures and photo-etchings. His fine portraits of well-known people taken in his Glasgow Pl 284 studio have been somewhat overshadowed by his pictorial work.

Julia Margaret Cameron's youngest son HENRY HERSCHEL HAY CAMERON became a professional portrait photographer in London in the mid-1880s. His portraits of celebrities unmistakably betray the influence of his mother's style; technically, his Pl 285 silver-prints are considerably better. In 1905 Cameron gave up photography to become an actor.

FREDERICK H. EVANS was a bookseller in the City of London until 1898 when he became a professional photographer, having been an amateur since the mid-1880s. Evans specialized in portraits of his literary and artistic friends, who included Aubrey Pl 286 Beardsley whom he set on his career as an illustrator, William Morris for whom he photographed Kelmscott Manor, and G. B. Shaw who staged for him a special camera performance of *Mrs Warren's Profession* in 1902. Evans is perhaps still better known for his series of photographs of English cathedrals, beginning in 1896 with Pl 288 Lincoln and later continued for *Country Life*, for which magazine he also photographed many French châteaux and cathedrals before 1914. He brought sensitive interpretation to architectural photography and raised this branch–hitherto regarded in England as merely record work–to an art. Evans was a firm believer in pure technique, and gave up photography when his favourite platinum paper became unobtainable during the First World War.

FREDERICK H. HOLLYER, a professional portrait photographer since the 1870s, was prominent during the 1890s and the Edwardian period for his excellent portraits of well-known artists photographed in their own surroundings. He too was a purist, and his platinotypes are refreshingly free from stereotyped effects. Hollyer devoted only one day a week to portraiture, the rest were spent on the reproduction of paintings, in which field he ranked as the greatest specialist in Britain.

ALEXANDER KEIGHLEY, an amateur, was Britain's leading pictorialist after the death of Horsley Hinton in 1908. In Keighley's large idealized romantic landscapes the composition was 'improved' by hand-work. He used the carbon process and sometimes the oil print right up to the 1940s. Keighley had a liking for sunlit objects highlighted from the surrounding gloom. 'The Bridge' is a typical Keighley version of a Pl 287 simple Venetian scene.

At the time of the formation of the Linked Ring it seemed natural that George Davison should assume leadership of the group, which was largely drawn to landscape work, in which the British had always excelled. Davison had gone to the Essex marshes for some of his best-known pictures, and a weekly exodus of the secessionists to Canvey Island and the Blackwater resulted. Going into Essex, the photographers could not help discovering the Constable country, which also formed the subject of many pictures, chiefly by Horsley Hinton. As editor of *The Amateur Photographer* he strove ceaselessly for the recognition of photography as an art medium, and his own landscapes lent force to his arguments. A strong personality of moderate views, Horsley Hinton was ideally suited to unite men of divergent opinions, a task made more difficult when the Linked Ring before long became the spiritual leader of similar secessionist groups of artistic amateurs on the Continent and in New York, Fig 66 culminating in 1904 in the formation of the International Society of Pictorial Photographers. Owing to their long tradition in pictorial photography the British seemed the natural leaders, and the first and only president of the association was J. Craig Annan.

The Linked Ring held its first exhibition in October 1893 at the Dudley Gallery, Piccadilly, London, and for the next fifteen years its Salon was the most important annual event in the photographic world, to which the leading Continental and American pictorialists contributed. After the demolition of the Dudley Gallery in 1905 the Salon was held at the gallery of the Royal Society of Painters in Water Colours until the dissolution of the Linked Ring in 1910. This came about in a rather curious way. In 1909 F. J. MORTIMER, Horsley Hinton's successor as editor of *The Amateur Photographer*, organized at the paper's offices a 'Salon des Refusés' of pictures not admitted to the Salon of the Linked Ring, which was by this time no longer considered progressive. The success of Mortimer's exhibition led to the dissolution of the Linked Ring and the foundation of the London Salon of Photography, which held its annual shows in the same gallery from 1910 to the present day–though now again much overdue for reform.

Mortimer was for forty years a prominent interpreter of the sea in all its moods, the counterpart of FRANZ SCHENSKY in Heligoland.

One of the founder-members of the new London Salon was EMIL OTTO HOPPÉ, Pl 289 who had just set up as a portrait photographer of celebrities in the former studio of Sir John Millais. He was a prominent exhibitor and an influential writer on the art of photography in English and foreign journals. Hoppé's only concession to the taste of the time was a soft-focus effect. Today Hoppé is chiefly remembered for his brilliant travel photographs from all four corners of the world, in which field he specialized after the First World War, but his first publication, a portfolio of fifteen *Studies from the Russian Ballet* (1912), deserves to be better known.

Though not connected with any group or society, ALICE HUGHES must not be Pl 290 overlooked. She was a brilliant Court and Society photographer in London from 1886 on, and her superb platinotype prints are the epitome of an elegant age. She worked in the tradition of Camille Silvy, and in her turn probably influenced Cecil Beaton.

38 The aesthetic movement

Held together by common aims, there was nevertheless a divergence of opinion among members of the Linked Ring as to what constituted pictorial photography and, in particular, what printing techniques would serve its purpose best. All of them agreed that ordinary silver-prints were 'quite unsuitable for hanging on walls as pictures, to be admired at a distance'. Some of them, unwilling to make any concession to interference with the camera image by diffusion or graphic means, chose the platinotype. Others favoured hand-made photo-etchings and photogravures, introduced into pictorial photography by Emerson as being softer and more artistic in effect than glossy photographic prints. The adherents of Davidson's impressionism demanded still greater softness. Blurring the image by optical means (such as a pinhole lens, a simple spectacle lens, or a specially constructed soft-focus lens like that designed in 1896 by Thomas Ross Dallmeyer at the suggestion of J. S. Bergheim, a painter) and printing the picture on coarse-grained paper to break up the smooth half-tones were perhaps defensible as legitimate photographic technique. But soon the notion got around that even these failed to overcome the literalness of photography. For the first time a new conception of the aesthetics of photography was formulated, which claimed for the photographer the same freedom of composition as that enjoyed by the painter, who is not bound by representation but gives a free version of the subject, omitting or altering anything that would impair his composition. Is not the photographer too, it was argued, justified in modifying the image by manual interference to conquer the limitations of his medium, which restrict his powers of expression?

Controlled Printing Processes. These were made possible by the gum bichromate process or gum print introduced in 1894 by A. ROUILLÉ-LADÊVEZE and popularized the following year by ROBERT DEMACHY. It was an adaptation of Poitevin's gum bichromate process invented forty years earlier in the search for a permanent printing process. It enabled the photographer to control the printing, omit details, change tone values, and by a great variety of manipulations to modify the photograph to such an extent that it became the result of hand-work far removed from the original camera image. By adding different pigments and using rough drawing-paper the picture could be given the appearance of a red chalk or charcoal drawing; by exposing the negative initially to coarse canvas the photograph could even be made to imitate a reproduction of a painting. 'Precious daubs' and 'meretricious efforts', sneered Emerson, but to the 'paper stainers' this was photographic Art with a capital A. Nothing delighted them more than the exclamation, 'By Jove, that doesn't look a bit like a photograph!'

During the next dozen years other controlled printing processes were introduced, most of them demanding much manual skill and time: the Ozotype (1899), the oil print (1904), the Ozobrome print (1905), and the bromoil print (1907). These *Edeldrucke* (noble prints) as the Germans call them, enjoyed great popularity with–in the main–amateurs hoping to win medals at photographic exhibitions, but they were far from ennobling photography. It is astonishing how frequently the creator of such hybrids was only plagiarizing paintings, yet he was accepted by painters and critics alike as an artist infinitely superior to the photographers who remained true to their medium. The famous portrait painter Franz von Lenbach (who relied on photographs extensively as studies) was so impressed by a photographic exhibition at the Munich Artists' Secession in 1898 that he had himself locked in during the lunch-hour closure in order to study the pictures undisturbed. A well-known Munich art critic, Dr Karl Voll, was completely conquered by photography on seeing this exhibition.

> The results no longer have anything in common with what used to be known as photography. For that reason, one could proudly say that these photographers have broken with the tradition of the artificial reproduction of nature. They have freed themselves from photography. They have sought the ideal in the works of artists. They have done away with photographic sharpness, the clear and disturbing representation of details, so that they can achieve simple, broad effects.[1]

George Bernard Shaw had a better understanding of the true nature of photography. A staunch supporter of photography as an art, he could not deny that these manipulated photographs had a certain charm, yet he knew that he ought to condemn trickery and the critics who hailed it.

> When the photographer takes to forgery, the press encourages him. The critics, being professional connoisseurs of the shiftiest of the old makeshifts, come to the galleries where the forgeries are exhibited. They find to their relief that here, instead of a new business for them to learn, is a row of monochromes which their old jargon fits like a glove. Forthwith they proclaim that photography has become an art.[2]

Despite occasional criticism, Shaw was so impressed by the ever-widening scope of art photography that he made the audacious prophecy:

> Some day the camera will do the work of Velasquez and Pieter de Hoogh, colour and all. The artists have still left to them invention, and for a little while longer, colour. But selection and representation, covering ninety-nine-hundredths of our annual output of art, belong henceforth to photography.[3]

Like practically every other art critic before him, Shaw fell into the same error of measuring the artistic merits of photography by comparison with Old Master paintings, and in his own inimitable way tried to confirm Delaroche's opinion that painting was dead. Speaking of some photographic portraits of himself (by Evans), Shavian exaggeration knew no bounds: 'Compare them with the best work with pencil, crayon, brush or silver-point you can find–with Holbein's finest Tudor drawings, with Rembrandt's "Saskia", with Velasquez' "Admiral", with anything you like–if you cannot see at a glance that the old game is up, that the camera has hopelessly beaten the pencil and paintbrush as an instrument of artistic representation, then you will never make a true critic.'[4]

Indeed, at this period imitating the style of the Old Masters was the curious ambition of many pictorial photographers. They took great pains to achieve historical accuracy and most of their pictures are remarkably clever imitations photographed in a straightforward realistic way. J. C. STRAUSS, an American, in 1904 started a whole series of 'Portraits after the Old Masters'–Rembrandt, Frans Hals, Van Dyck, Pl 292 Gainsborough and others. The Italian GUIDO REY made *genre* pictures in the style of almost every century, from Graeco-Roman *tableaux* in the manner of Alma-Tadema and Leighton, to the French Empire, a period which also attracted COMMANDANT PUYO. FRED BOISSONNAS of Geneva delighted in staging elaborate composition pictures such as 'Faust in his Study', whilst the Dutchman RICHARD POLAK specialized Pl 293 in seventeenth-century Dutch *genre* pictures. Others imitated the puerile academic painting at the turn of the century–Alma-Tadema, Leighton, Bouguereau, Klinger, Stuck, Grützner and others. Grecian maidens, Roman senators, Cleopatras in shapeless robes clutching a stuffed snake, knights in armour, carousing monks, and even sacred subjects suitable only for the artist with brush or pencil appeared. The Americans F. HOLLAND DAY and LEJAREN À HILLER, and L. BOVIER in Belgium, composed Crucifixions and Entombments–extraordinary aberrations of taste when made for exhibition.

Impressionistic photography and imitation paintings became epidemics obscuring the judgment of many gifted photographers. Both misconceptions of the purpose of photography arose out of a misdirected ambition to win recognition as artists–a repetition of the mistake made by the High Art photographers of the mid-nineteenth century. Whenever one art borrows the characteristics of another and forsakes its own distinctive qualities, it is decadent; and that the art photography of the *art nouveau* period certainly was.

The Salon formed by the fashionable Photo-Club de Paris in 1894 had a similar effect in France to the Salon of the Linked Ring in England. MAURICE BUCQUET, its founder and president, made exquisite pictures of street life full of atmosphere, Pl 291 achieving his effects by purely photographic means. ROBERT DEMACHY, a banker, and COMMANDANT ÉMILE JOACHIM CONSTANT PUYO achieved international renown with their gum prints. With inventive genius and elegance of style–though not with- Pls 294–296 out occasional lapses of taste–they portrayed feminine grace, and also took many delightful landscapes with figures. Demachy's ballet dancer has the charm of a Degas Pl 294 pastel–but is it Degas or Demachy we admire? Puyo, a squadron leader at the School of Artillery at La Fère, even left the army in 1902 in order to devote himself entirely to his hobby. His balcony scene with Montmartre in the background was inspired by Pl 295 Edvard Munch's painting entitled 'Rue Lafayette' (1891). A leading French art critic, R. de la Sizeranne, supported the French group and 'les procédés d'art en photographie', under which title Demachy and Puyo published a book.

The most prominent members of the Vienna Camera Club, which organized its first exhibition in 1891, were HEINRICH KÜHN, DR HUGO HENNEBERG, PROFESSOR HANS WATZEK and DR FRIEDRICH SPITZER. Like the French pictorialists, the Austrian group had become affiliated to the Linked Ring by 1895. The most important was Kühn, an amateur since 1879 and a prominent exhibitor of portraits and landscapes. In 1897 he introduced the multiple gum print in which various pigments could be used to give several colours to the picture in a number of superimposed printings. Kühn's Venetian canal scene, a gum print in charcoal colour, has much the appearance Pl 299 of a reproduction of a watercolour by John Singer Sargent. Watzek's lively studies of peasants seem to come straight from Wilhelm Leibl. PAUL PICHIER, another Pl 298 Austrian, created Böcklinesque landscapes with cypress trees and figures.

It is strange that Germany, since the 1920s in the forefront of progressive artistic photography, made no outstanding contribution in the field of creative photography until the end of the nineteenth century. Here, as in most other countries apart from Britain and France and to some extent the United States, photography was completely stagnant, being in the main practised by professional portraitists. This is further emphasized by the technical bias of the photographic magazines published in German-speaking countries. Hence the few people who were conscious of this lack of artistic outlook were particularly keen in their support of the aesthetic movement which originated in Hamburg under the best auspices. Its greatest impulse came from ERNST W. JUHL, founder of the Society for the Advancement of Amateur Photography Pl 301 in Hamburg, organizer of the international exhibitions held at the Hamburg Kunsthalle from 1893 to 1903 (with the exception of 1901) and an influential writer.[5] PROFESSOR ALFRED LICHTWARK, director of the Kunsthalle, was one of the first art historians to recognize the importance of photography as a means of artistic expression, though his motive in making his gallery available to photographic exhibitions–something quite unheard of in Germany in those days–was the expectation that photography would re-vitalize painting, and especially portrait painting which had almost died out. To the public the mere idea of a photographic exhibition in a leading art gallery seemed as incongruous as holding a scientific congress in a church. No fewer than 6,000 amateur photographs were shown at the first exhibition in 1893. Six years later, calotype portraits by Hill and Adamson, seen for the first time outside Britain, were considered the highlight of the show despite the fact that the leading English, French, Austrian and American artistic photographers were represented in force. The calotypes, sent in to the exhibition by J. Craig Annan who brought about a revival of interest in Hill and Adamson, came as a revelation that artistic photography had existed half a century before those who considered themselves its pioneers. In Hill's portraits, stressed Lichtwark, the characteristics of the sitter had not been interfered with by retouching–then much practised by professional photographers–and as long as the public demanded and received flattering and therefore characterless photographic portraits, he feared that they would not be able to appreciate truth in painting. This was a complete reversal of the situation during the early decades of photography, when photographers complained that they were obliged to flatter the sitter because artists had made people accustomed to idealized portraits.

The influence of the Hamburg exhibitions and those in other German cities, Erfurt (1894), Berlin (1896), etc., was particularly marked in photographic portraiture, for in Germany it was not so much amateurs as a number of professional portrait photographers who became the leading supporters of the controlled printing processes: Pl 297 RUDOLF DÜHRKOOP (Hamburg), HUGO ERFURTH (Dresden), NICOLA PERSCHEID (Leipzig, after 1905 Berlin), WILHELM WEIMER (Darmstadt) and FRANZ GRAINER (Munich). All of them in the following decades imbued portraiture with an artistic quality that had previously been lacking. The *art nouveau* photography did, however, produce some gifted amateurs such as the brothers THEODOR and OSKAR HOFMEISTER Pl 303 and GEORG EINBECK (Hamburg), and FRAU E. NOTHMANN (Berlin) whose picture 'In the Garden' has the softness and attractiveness of a Renoir, though not directly indebted to him.

Within a few years the Hamburg exhibitions raised the quality and status of professional and amateur photography in Germany to an unprecedented level, winning official recognition in the highest circles. The Empress Frederick accepted patronage of a big international exhibition of artistic photography in the Reichstag building in 1896. Two years later modern painters in Munich opened the doors of their Secession to the aesthetic movement, and in February 1899 even the Royal Academy in Berlin embraced photography. So before the end of the nineteenth century the longstanding prejudice of the art world against photography was, at least temporarily, overcome. At no time during its entire history was photography held in such high esteem by painters as during its decadent *fin-de-siècle* period. This *rapprochement* was a marriage of convenience from which each partner expected to profit: the photographers by recognition, the painters by photographic subject matter, for by this time most well-known painters–including Millais and Lenbach–had dark-rooms attached to their studios.

Lichtwark and Juhl had every reason to be satisfied with the results of their efforts. The former stated that 'in barely five years the German amateur photographers, until then the last, have come to the fore and brought to Germany, too, the decorative quality of photography as manifested in artistic expression and form.'[6] There is no innovation that does not find its detractors, and many people, mostly photographers, rightly disapproved of 'photo-paintings', which manipulated prints in the main were. Robert Demachy wrote of heated discussions at an exhibition in Paris in 1902 of the work of the young American painter and photographer EDWARD STEICHEN. One photograph was a self-portrait in the style of Lenbach, with palette and brush, more hand-work than photography. Another was the memorable picture of Rodin silhouetted against the luminous whiteness of his statue of Victor Hugo, contemplating his 'Thinker'. Pl 304 (Six years later Steichen photographed by moonlight Rodin's statue of Balzac, silhouetting it against the night sky; the result was a misty, soft outline which surprisingly Rodin liked, although it was the complete antithesis of what the sculptor tries to achieve–plastic form.) There were also in the 1902 exhibition a number of murky female nudes who looked–said G.B.S.–as though they had been posed in a coal cellar. A visitor complained of a particular picture: 'If this were a charcoal drawing it would be excellent, but as it is a photograph, it is horrible.' When Ernst Juhl, for many years art editor of the *Photographische Rundschau*, in July 1902 wrote a short article on this exhibition, illustrated with twelve of the photographs that had caused such a sensation in Paris, the magazine was inundated with complaints from people threatening to cancel their subscriptions unless the artistic direction were changed. Whereupon Juhl resigned his position, and in view of this opposition the photographic exhibitions at the Hamburg Kunsthalle ceased in 1904.

Juhl's successor at the *Photographische Rundschau* was FRITZ MATTHIES-MASUREN, formerly a painter, and since 1893 a tireless supporter of the new photography in Germany both as editor of informative and superbly illustrated magazines[7] which stand on a par with Stieglitz's famous *Camera Work*, and author of *Die Künstlerische Photographie* (1907).

In Italy the first exhibition of artistic photography held in Florence in 1861 had been forgotten by 1895 when another one was arranged there and claimed as the first in which the creative possibilities of photography were apparent. This, and subsequent exhibitions in Turin in 1897 and particularly in 1900–the first international exhibition of artistic photography in Italy–aroused a widespread desire for photographic picture-making. The most prominent of the Italian pictorialists was GUIDO REY, others being CESARE SCHIAPARELLI, GATTI CASAZZA and GIACOMO GROSSO, an artist whose painting 'Il Supremo Convegno' was a *succès de scandale* at the first Venice Biennale in 1895.

The Association Belge de Photographie, founded in Brussels in 1874, was, like most other societies, rather technically orientated, and it is not surprising that the artistic members were dissatisfied and founded their own Cercle d'Art Photographique in 1900. The leading figure of this amateur circle, to which belonged well-known pictorialists such as C. PUTTEMANS, A. BOURGEOIS and M. VANDERKINDERE, was LÉONARD MISONNE, who for forty years produced variations on a single theme–stormy landscapes by late afternoon light. He was a master of *contre-jour* effects and in many of his landscapes the sun is breaking through clouds after rain. This was by no means always the natural effect, for a few good cloud negatives served Misonne for all his gum prints and bromoils.

Whilst the German and Italian pictorialists were not affiliated to the Linked Ring, the Americans under ALFRED STIEGLITZ formed its strongest and most progressive contingent. Stieglitz was a consistent advocate of the integrity of straight photography and owing to his influence a reaction set in in America against the manipulated print which owed more to the ingenuity of the photographer than to photography. Realizing that ordinary everyday scenes had not been sufficiently explored, he set out to show that this was a field offering ample scope for the creative photographer, without the need to stoop to any artifices. Although some of Stieglitz's photographs taken in the 1890s still show a certain influence of impressionism–in his preference Pl 307 for street scenes in wet or snowy weather or Monet-like railway stations–his approach was photographic.

When his aims clashed with the more conventional outlook of the New York Camera Club of which he was Vice-President, Stieglitz founded in 1902 the Photo-Secession with ALVIN LANGDON COBURN, FRANK EUGENE, GERTRUDE KÄSEBIER, Pl 300 EDWARD STEICHEN, CLARENCE H. WHITE and forty-one others. Some of the secessionists continued to cling to the controlled printing processes, foremost Edward Steichen; others shared their leader's belief in straightforward technique. All were agreed on two fundamental principles: the desirability of exploring photographic subject matter, and of concentration on rendering the subtleties of light.

> Let us use our instrument for the purpose for which it was intended: let us concentrate on doing the thing that we can do best, and not prostitute our medium by trying to do what we can accomplish only in a lesser degree, but what other mediums do easily and well. Let us do to the best of our ability that thing in which no other worker can rival us. Light, light, always light! . . . See and record its delicacy and daintiness in the upper ranges, its sombre play in the darks, its strength and vigour in the full scale, its infinite gradations, its infinite variety. . . . Ever and always use light to express your thought.[8]

Camera Work, the Photo-Secession's luxuriously produced quarterly journal, was started by Stieglitz in January 1903 with the aim of winning recognition for photography as art by publishing the work of leading contemporary American and European pictorial photographers. When he had exhausted this source the magazine became from 1908 onward the propaganda platform for modern art in general, for to Stieglitz all manifestations of it were equally important. With Edward Steichen he opened in November 1905 the Photo-Secession Gallery at 291 Fifth Avenue, New York–later called simply '291'–for shows of the controversial Photo-Secession Group and leading European photographers of the aesthetic movement, but gradually he extended its scope to champion anyone breaking new ground in art. Stieglitz's taste was far in advance of that of his contemporaries and made him the greatest protagonist of modern photography and modern art in the United States. It must be admitted that whilst the work of the artists still looks modern today, that of the photographers is, with a few exceptions, dated. Despite the fine photogravure illustrations in *Camera Work* the serious student cannot help discovering that the majority of Stieglitz's followers fell far short of his ideals, and one is sometimes puzzled how he could possibly have accepted their work at all. For most of it is arty, and some of it in questionable taste. Indeed, frequently it was as artificial as that which he was fighting against! Yet whilst an editor may occasionally oblige a subscriber–particularly when the circulation fell below fifty–it is surprising that he should pass for publication such ludicrous statements as: 'One should not say he [Steichen] recalls Rembrandt but rather at this rate Rembrandt will, in time, remind us of Steichen.' The conceit of the little art clique certainly knew no bounds.

With the help of Steichen, then living in Paris, Stieglitz introduced to America the work of many now famous artists: Rodin drawings and works by Matisse (1908), John Marin and Toulouse-Lautrec lithographs (1909), Henri Rousseau and Cézanne (1910), Picasso (1911), Picabia (1913), Brancusi and Braque (1914). Stieglitz also arranged the first exhibitions in the world of child art (1912) and Negro sculpture (1914) and furthered the development of what was later called Dadaism.

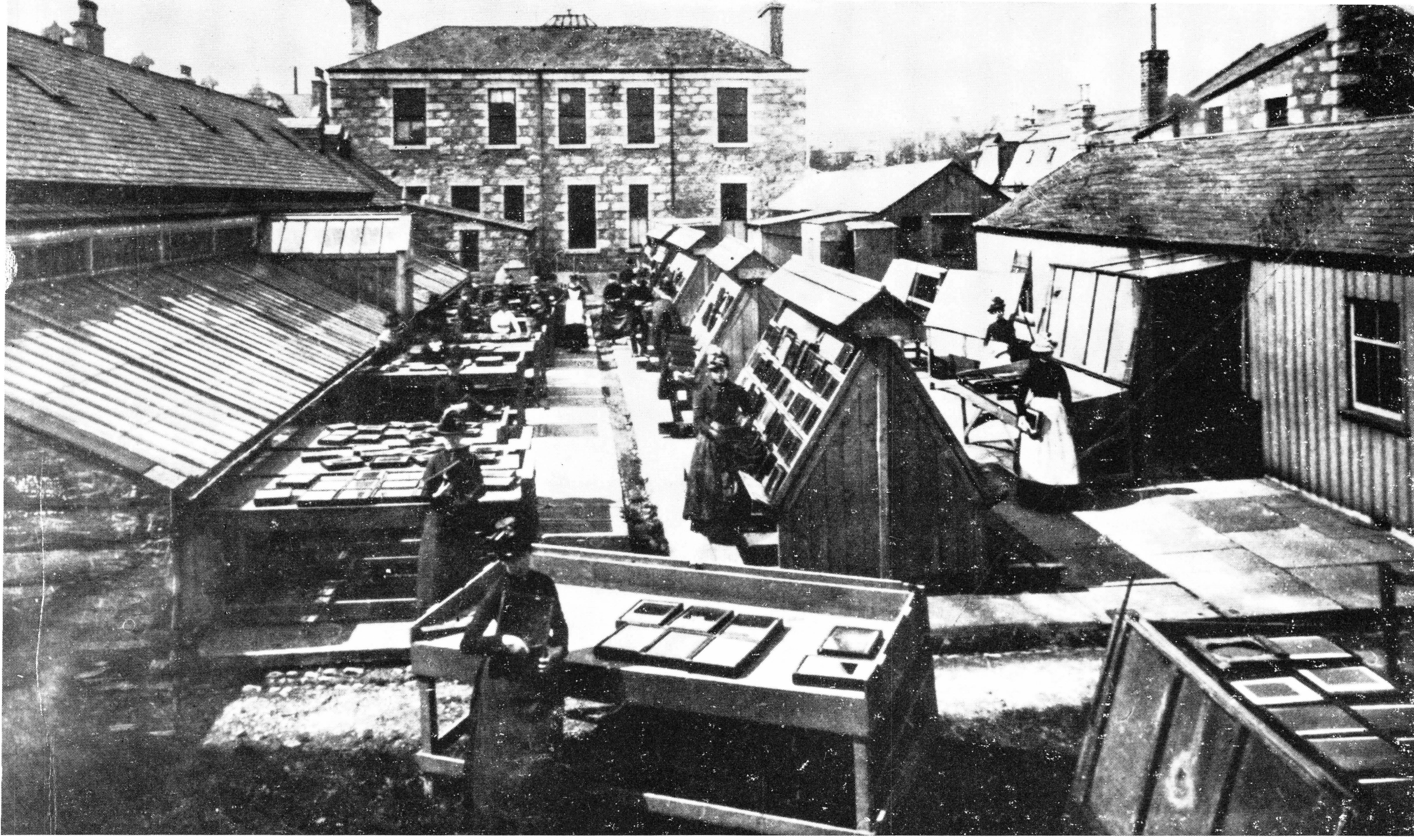
With his ever-increasing bias towards *avant-garde* art in *Camera Work* and at '291', the autocrat of the Photo-Secession understandably alienated most of its members, until by 1917 the subscribers to *Camera Work* had dwindled to thirty-six, and with America's entry into the war both magazine and gallery closed down.

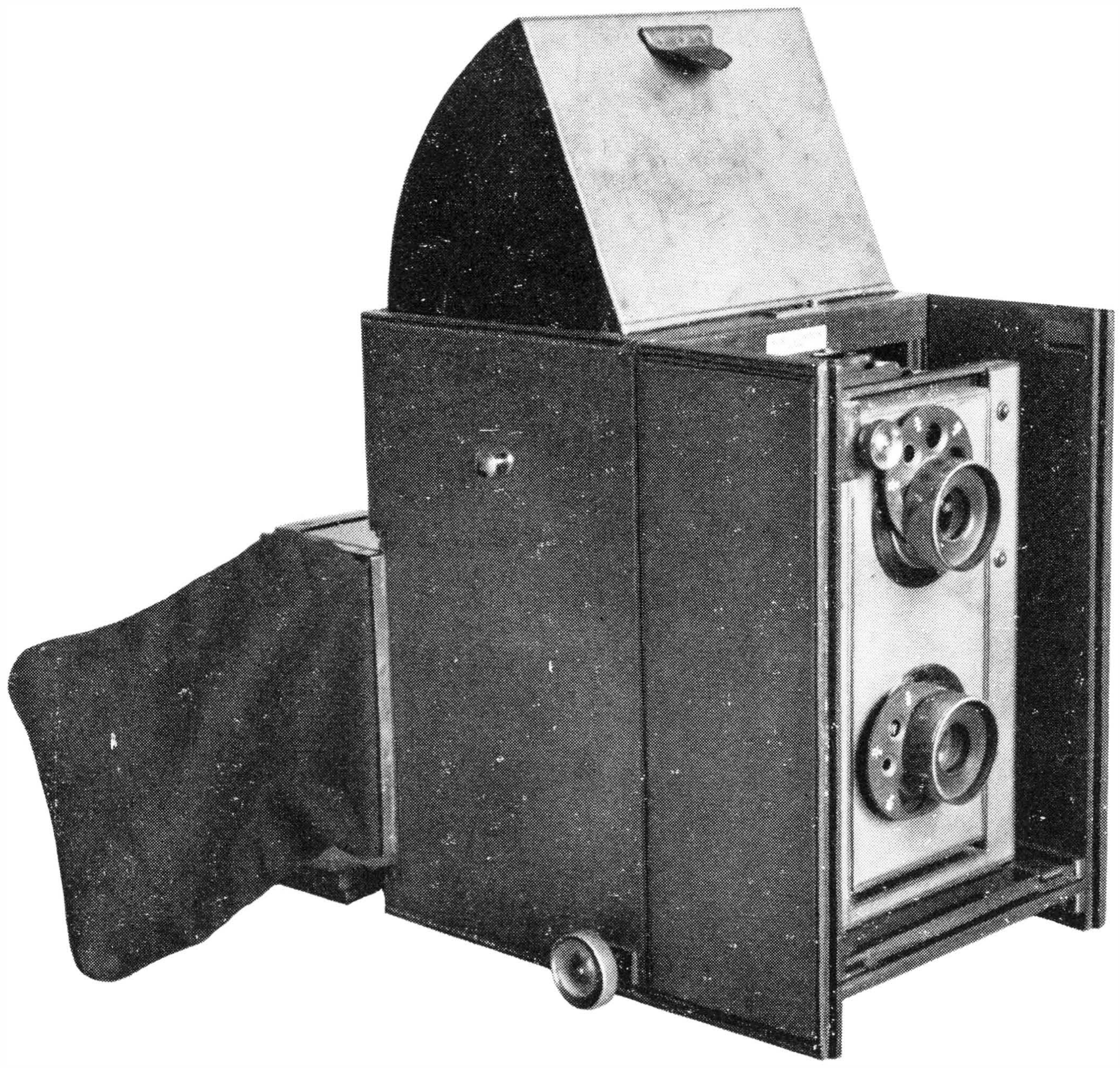
ALVIN LANGDON COBURN, a Boston painter and a member of the Photo-Secession and the Linked Ring, in 1906 established his reputation as a photographer in England with a one-man show at the Royal Photographic Society, which included a good many portraits of famous men, among them G. B. Shaw, who, always ready to beat the drum for photographers, wrote the foreword to the catalogue. Coburn's photographs of men and cities are distinguished by his exploring originality of approach. His books of photographs of London (1909), of New York (1910), and *Men of Mark* (1913) were illustrated with his own hand-made photogravures pulled on his own press. His liking for soft-focus was, in our opinion, regrettable as his portraits and views would have gained in vigour and brilliance if they were not diffused. Shaw with greater enthusiasm than perception pronounced in 1912: 'Steichen and Coburn are the two greatest photographers in the world.' The following year in a one-man show at the Goupil Gallery in London Coburn included five photographs of 'New York from its Pinnacles'. Realizing that the novelty of these bird's-eye views might puzzle the public, Coburn persuasively asked in the catalogue foreword: 'Why should not the camera artist break away from the outworn conventions, that even in its comparatively short existence have begun to cramp and restrict his medium, and claim the freedom of expression which any art must have to be alive?' His 'Octopus' Pl 308
is a landmark in modern photography as much as Stieglitz's 'The Steerage', 'The Pl 306
Circus Rider' by HARRY C. RUBINCAM, and a host of others. Pl 305

With the work of PAUL STRAND, the most progressive–and incidentally the last photographer to have an exhibition at '291', a new era begins. Aware that Strand's work represented a new conception of photography, Stieglitz devoted the last two issues of *Camera Work* (1917) entirely to his photographs of 1915/16, and for a full discussion of this formulator of objectivity we must refer the reader to another volume.[9]

The British, Continental and American groups of *fin-de-siècle* photographers exerted an undoubted influence on artistic photography, though their self-conscious picture-making led to the *cul-de-sac* 'art for art's sake' and contributed little to the progress of photography. Men like Thomson, Riis, Hine, Martin, Atget, Stone, and scores of amateur photographers totally indifferent to exhibitions and societies, used the camera instinctively as an objective commentator on life, without the need for wordy manifestos on the aims of photography. They planted the seeds of modern photography well before the First World War, though the full measure of their importance only began to find recognition with the changed outlook in the 1930s. 1914 marks the end of an era in photography as well as in social structure.

Plates 219–308



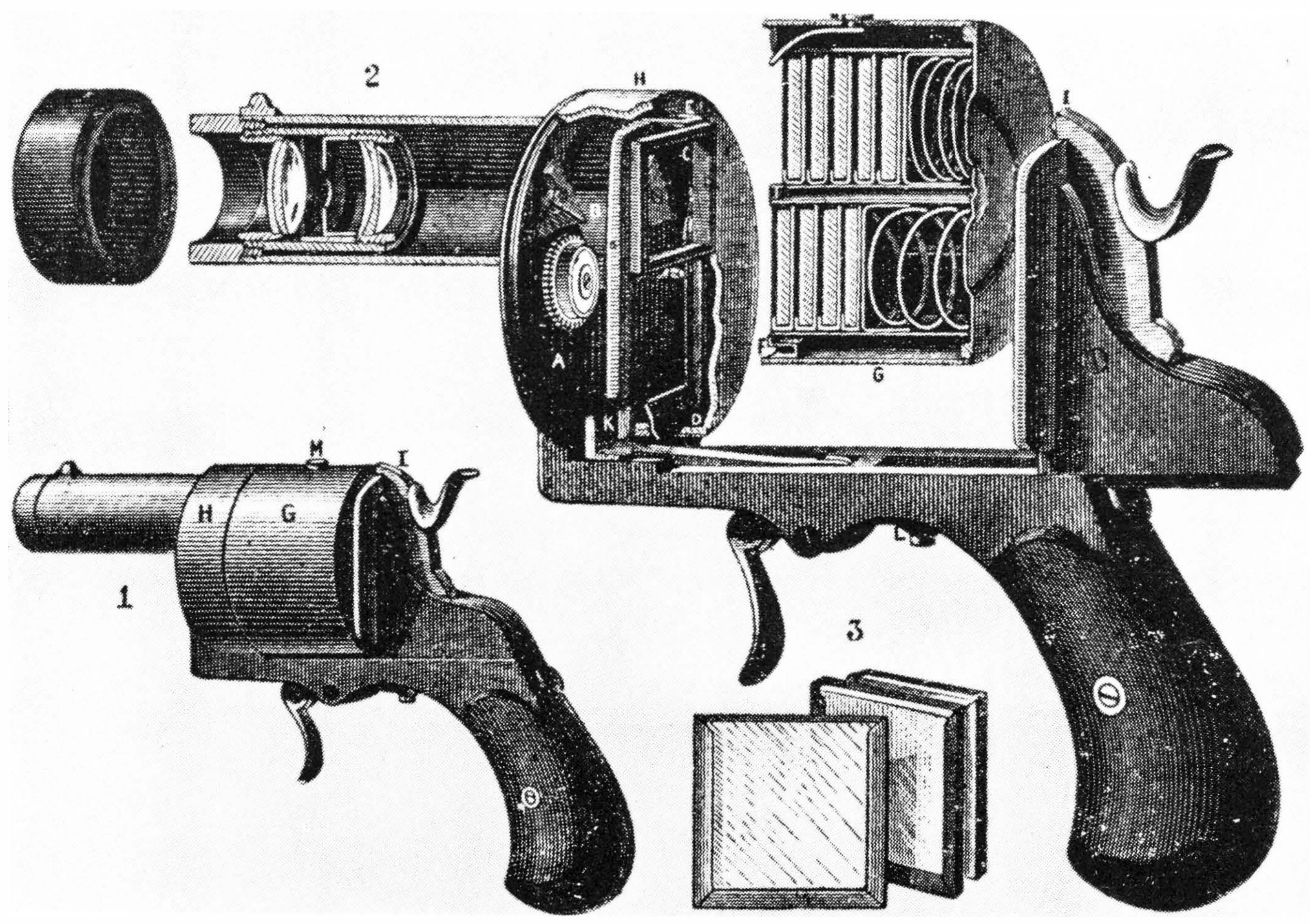


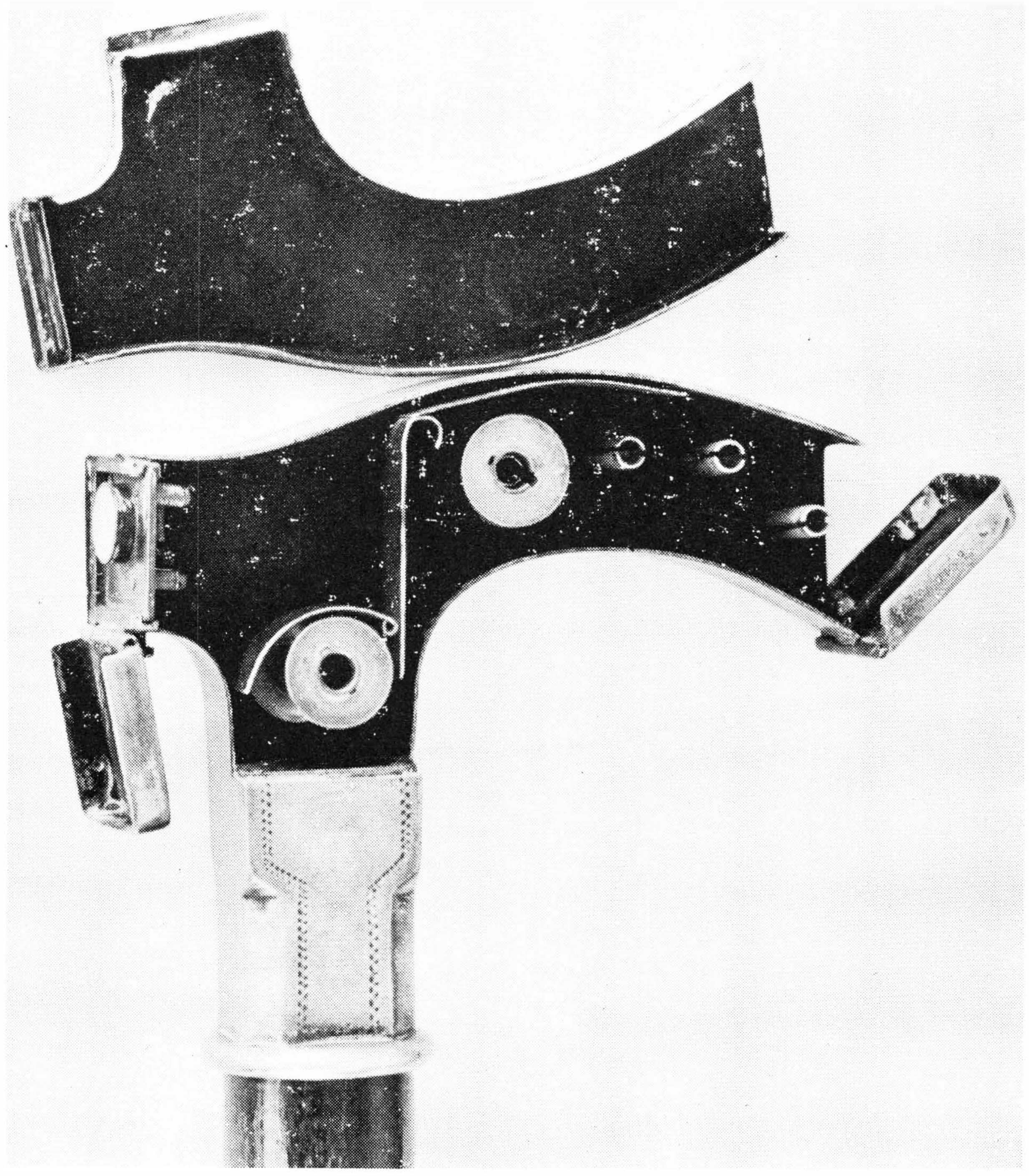
219 G. W. WILSON's printing works at St Swithin's Aberdeen, *c.* 1885

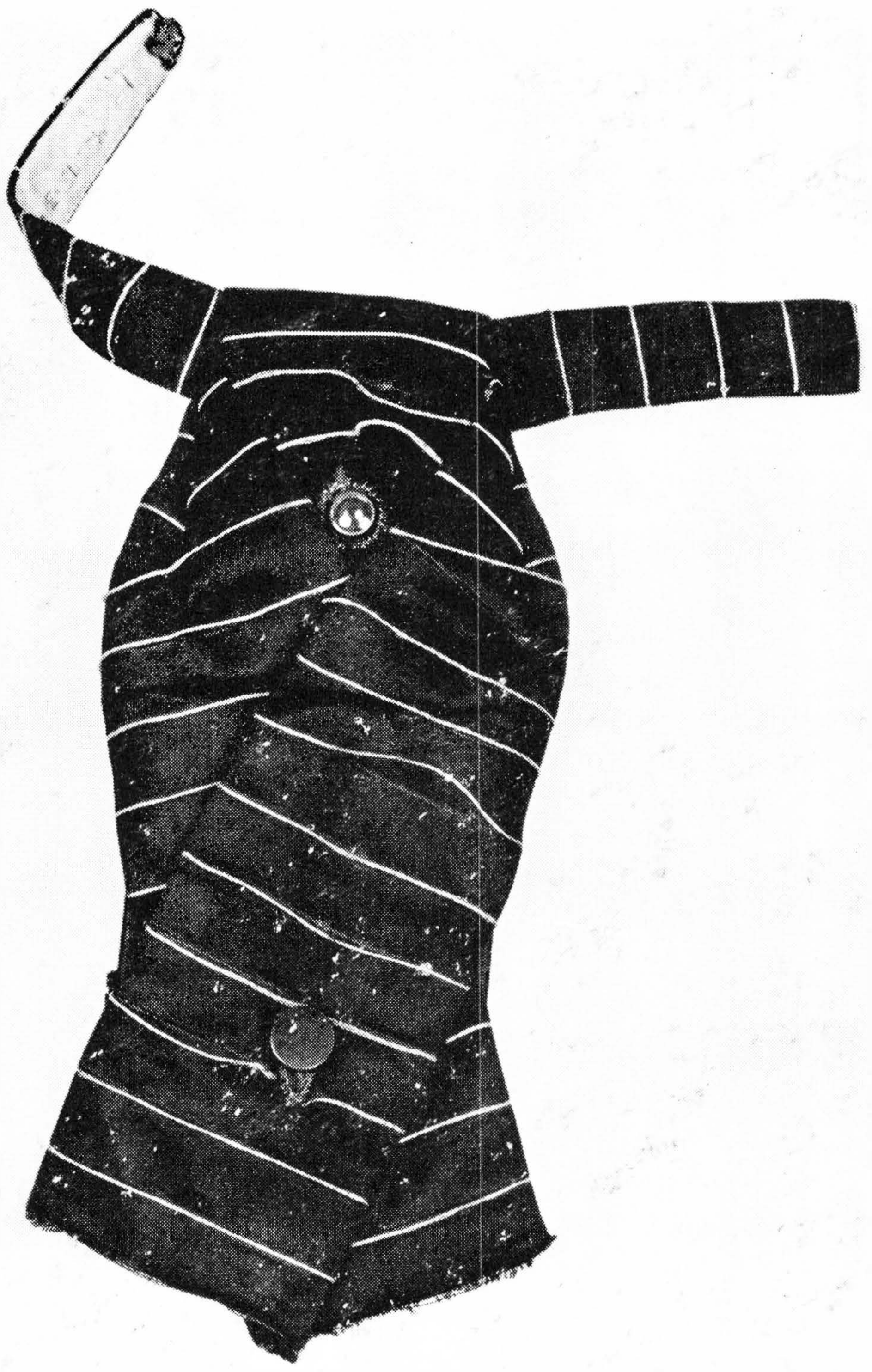
220 ROSS & CO's 'Divided' twin-lens reflex camera with change-box attached (5 in. × 4 in. model), 1891

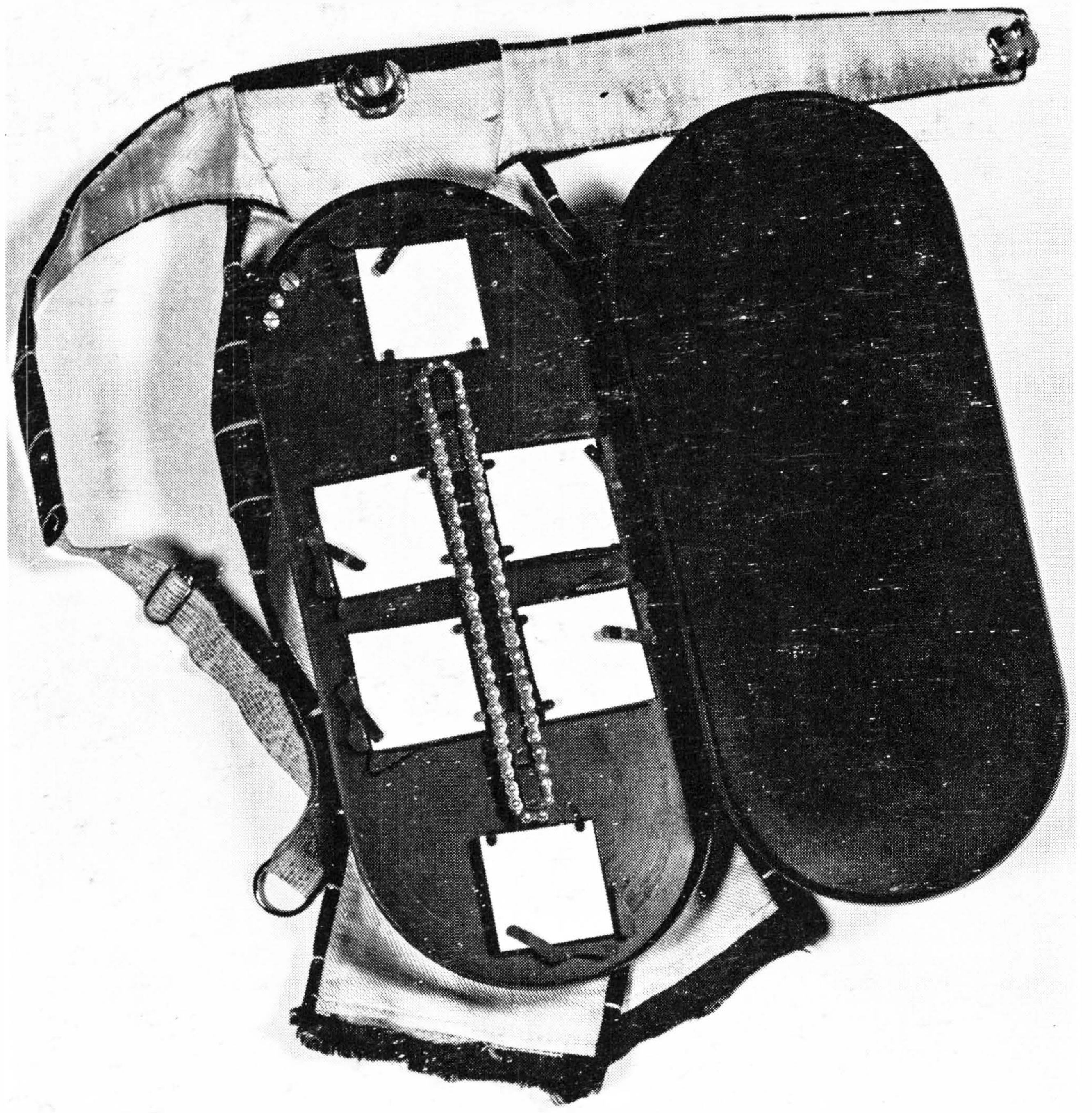
221 ENJALBERT's photographic revolver, 1882

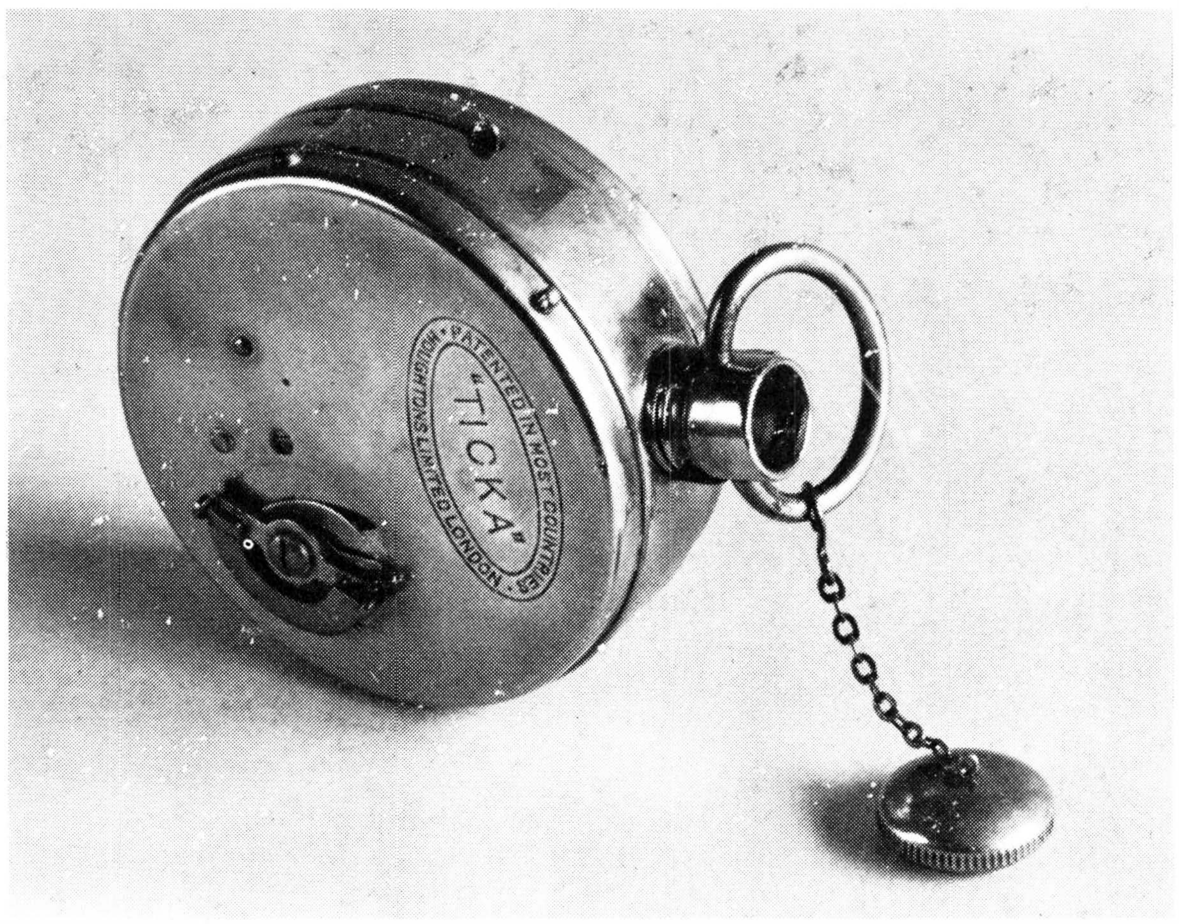
222 Walking-stick camera, introduced by A. LEHMANN, Berlin, 1903

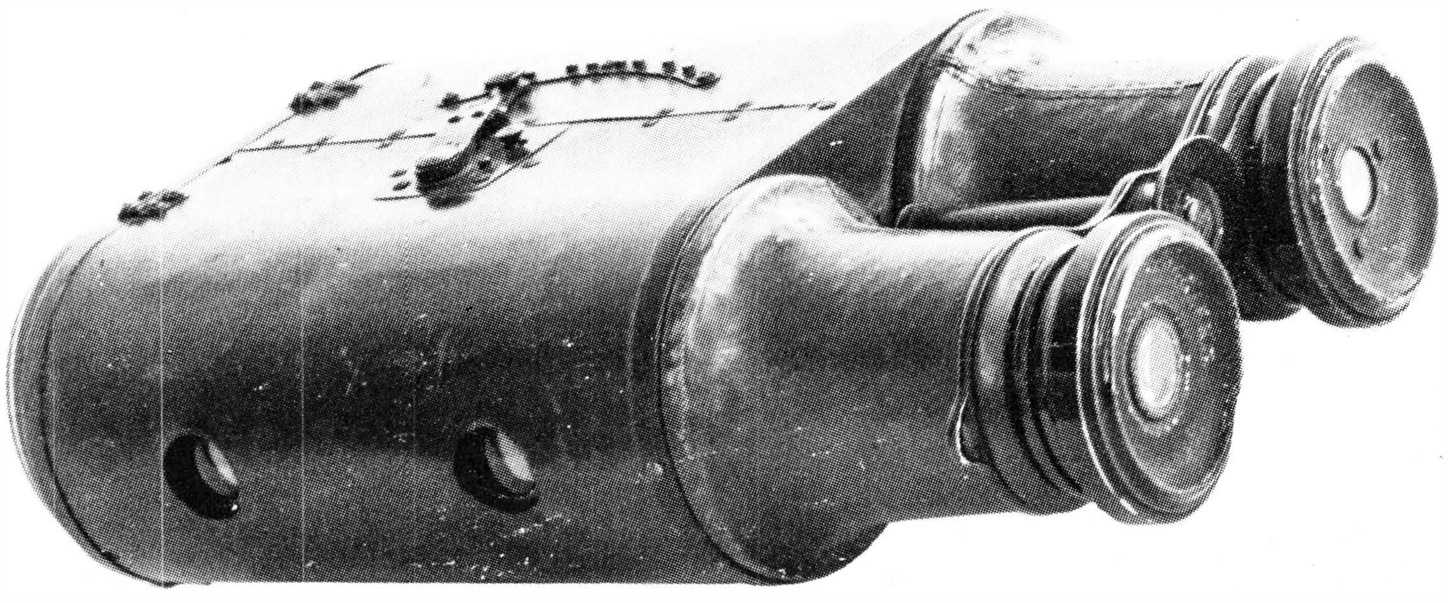


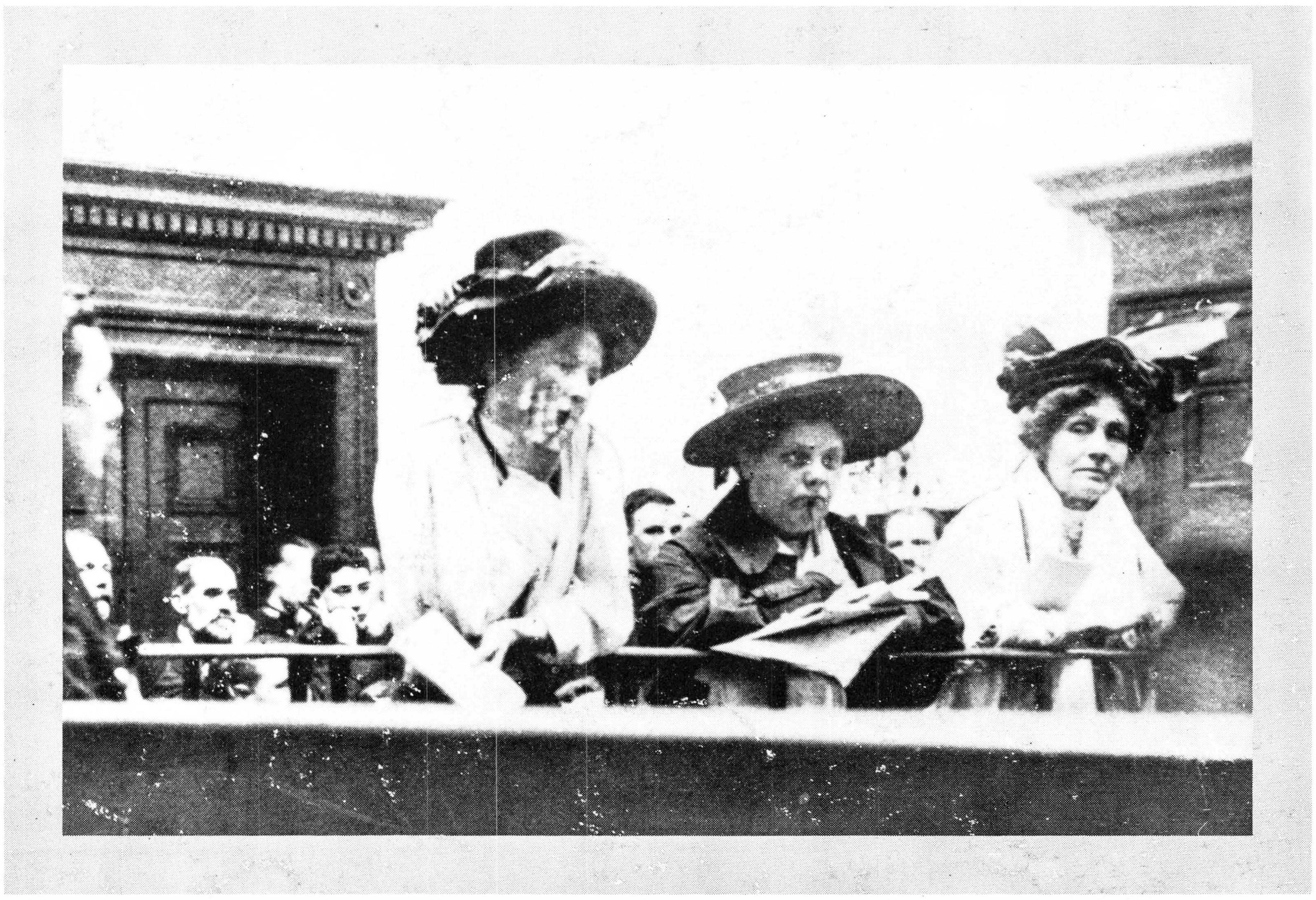







PATENTED IN MOST COUNTRIES
"TICKA"
HOUGHTONS LIMITED LONDON



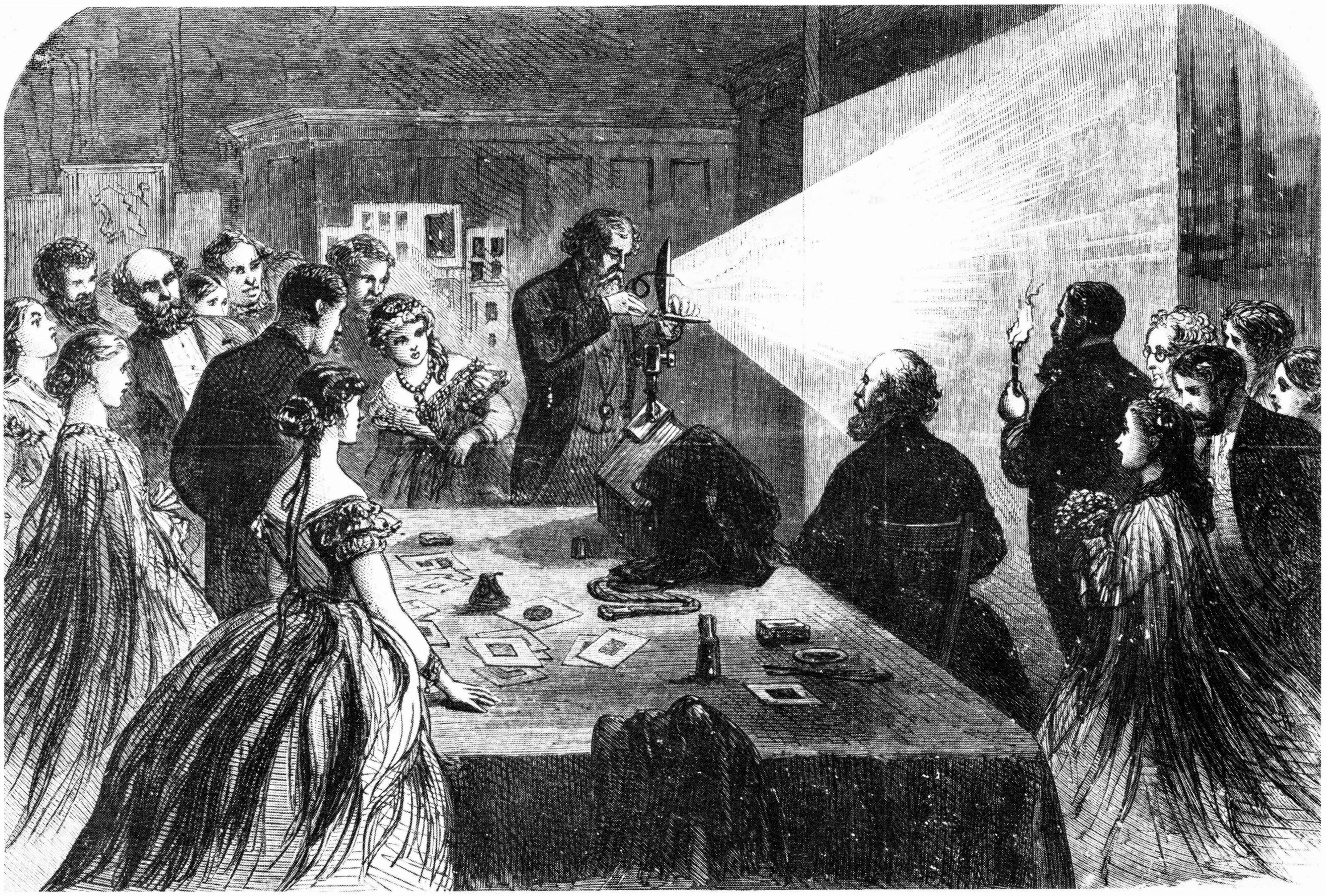


223, 224 Cravat camera, introduced by E. BLOCH, Paris, 1890: front view showing lens and button for changing plates; reverse showing plate-changing mechanism

225 'Ticka' watch camera, patented by M. NIELL, 1903

226 'Le Physiographe', introduced by E. BLOCH, Paris, 1896

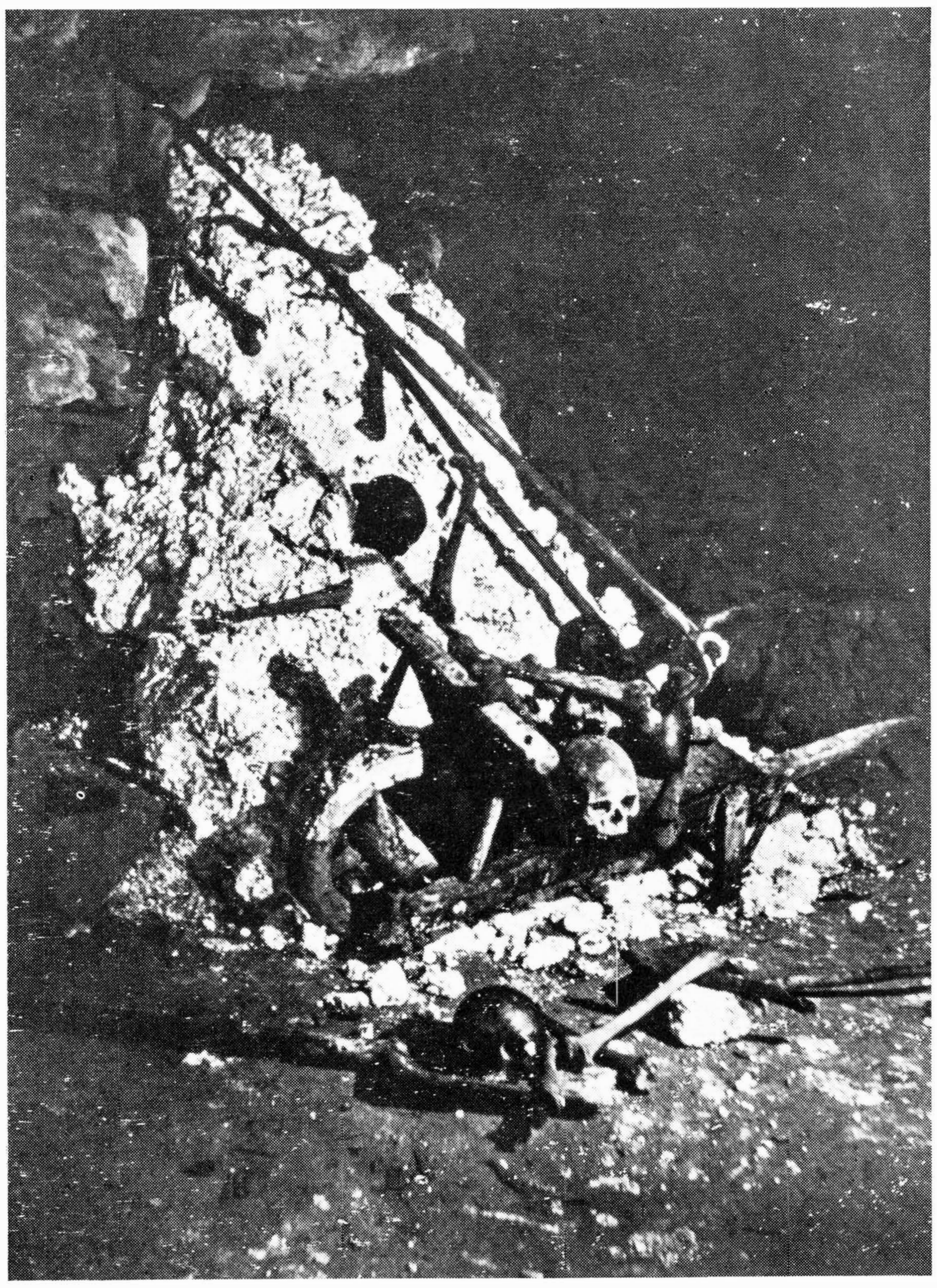
227 ARTHUR BARRETT. Suffragette leaders secretly photographed at Bow Street magistrate's court, London, October 1908: (from left to right) Christabel Pankhurst, Mrs Drummond, Mrs Pankhurst

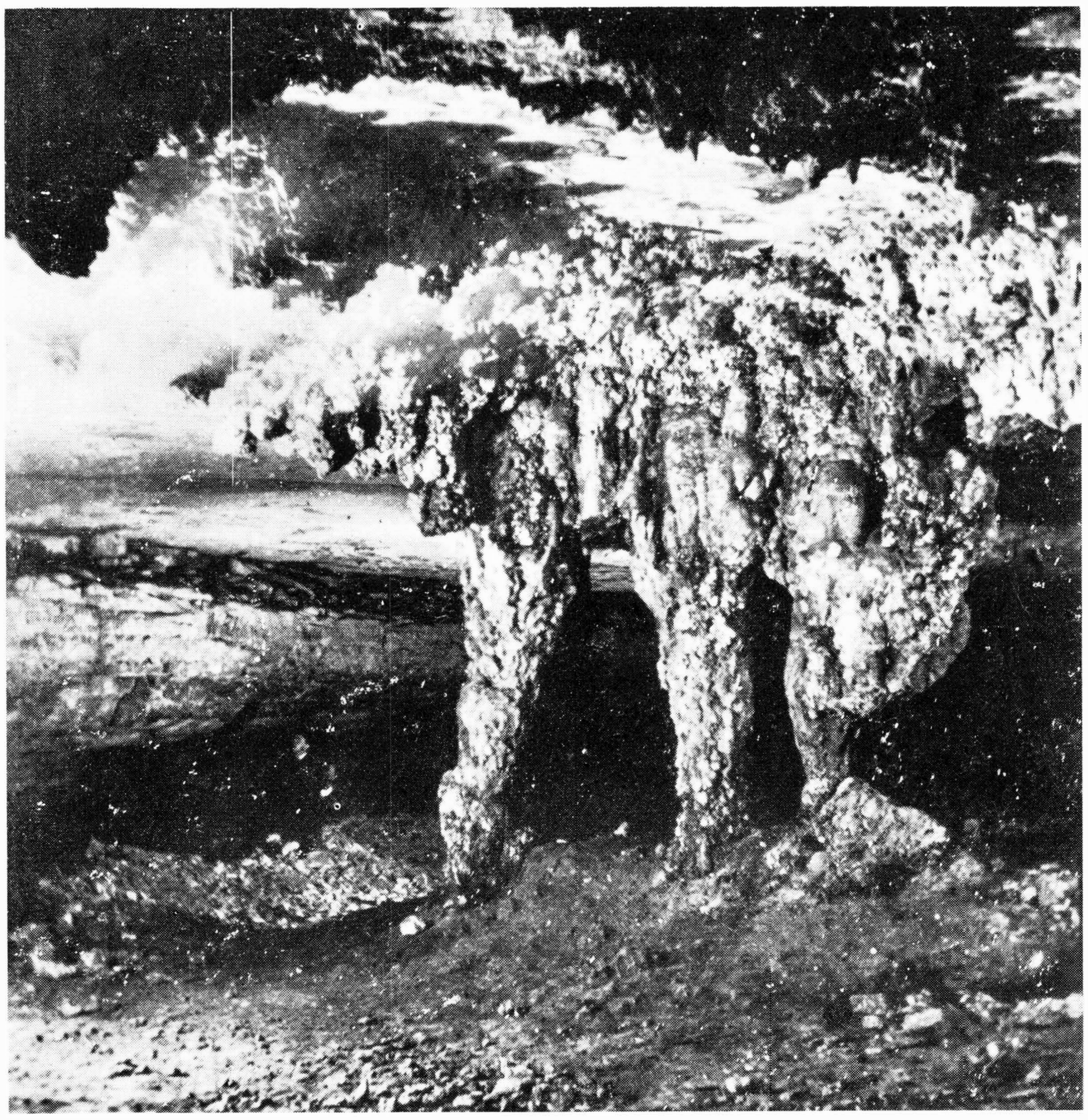


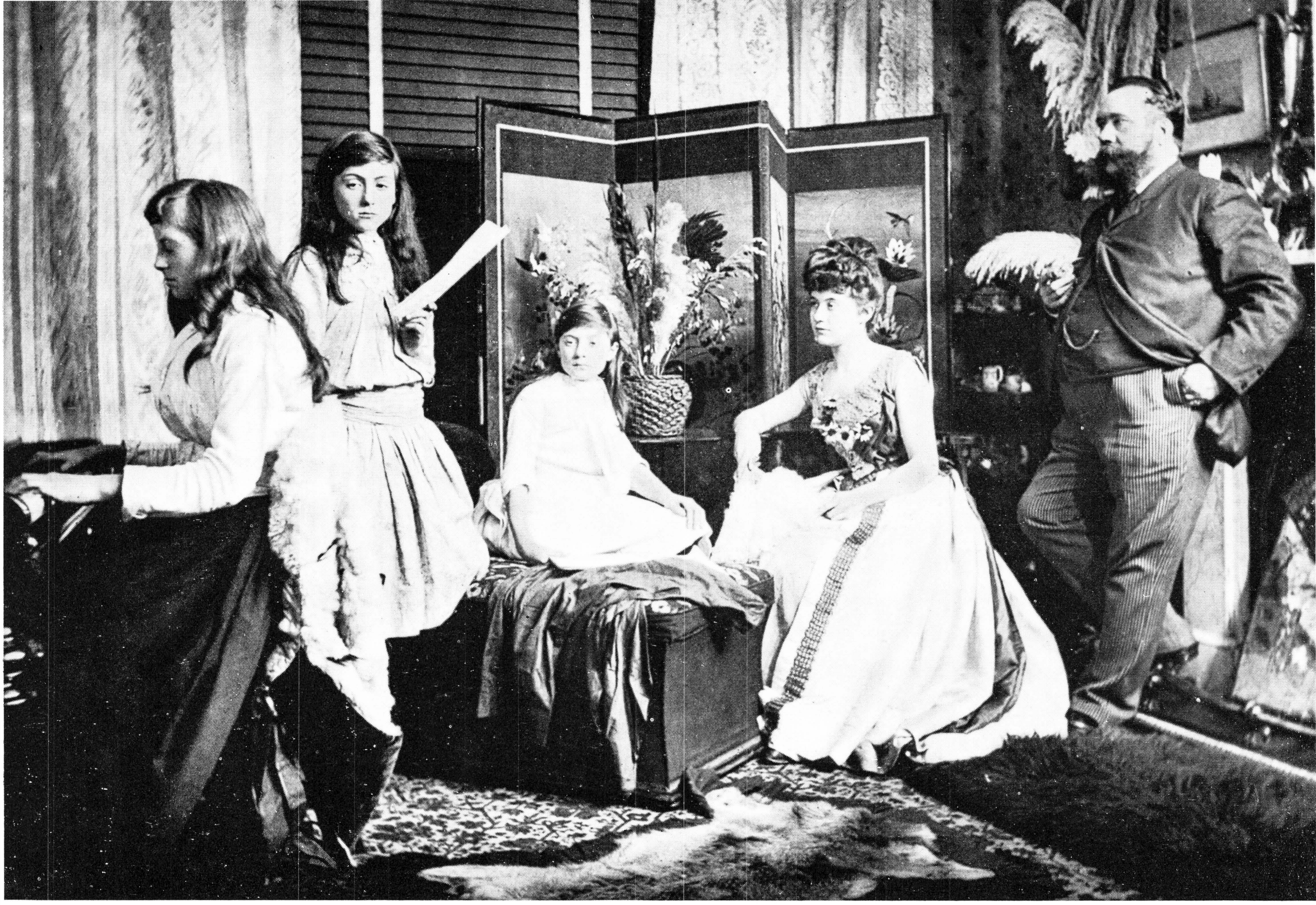
228 Demonstration of magnesium light at the British Association meeting, Birmingham, September 1865. From *The Illustrated London News*, 16 September 1865

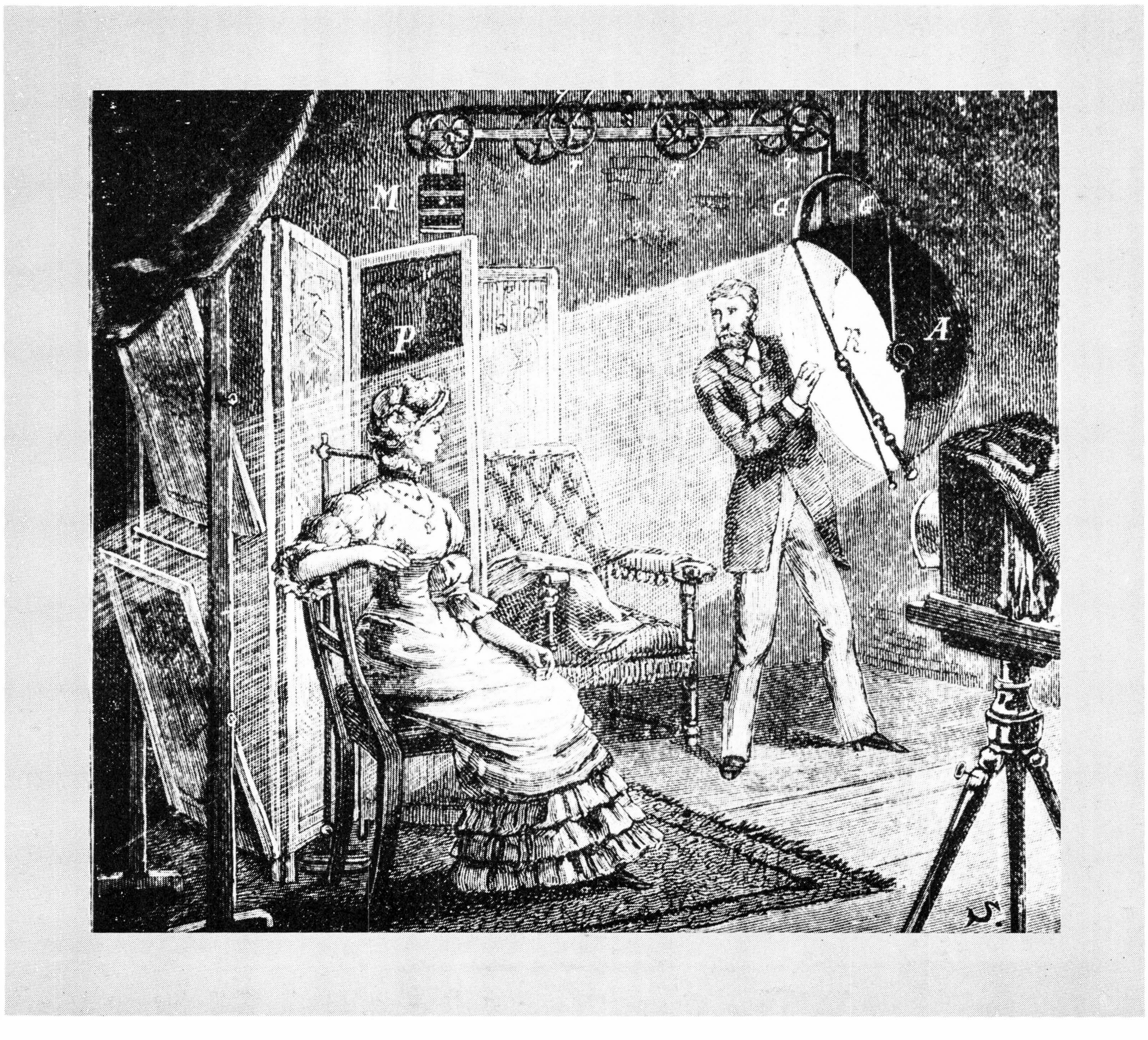
229 NADAR. The catacombs in Paris. Photograph by electric carbon arc light, *c.* 1861

230 CHARLES WALDACK. The Mammoth Caves, Kentucky. Stereoscopic photograph, taken by magnesium light, 1866







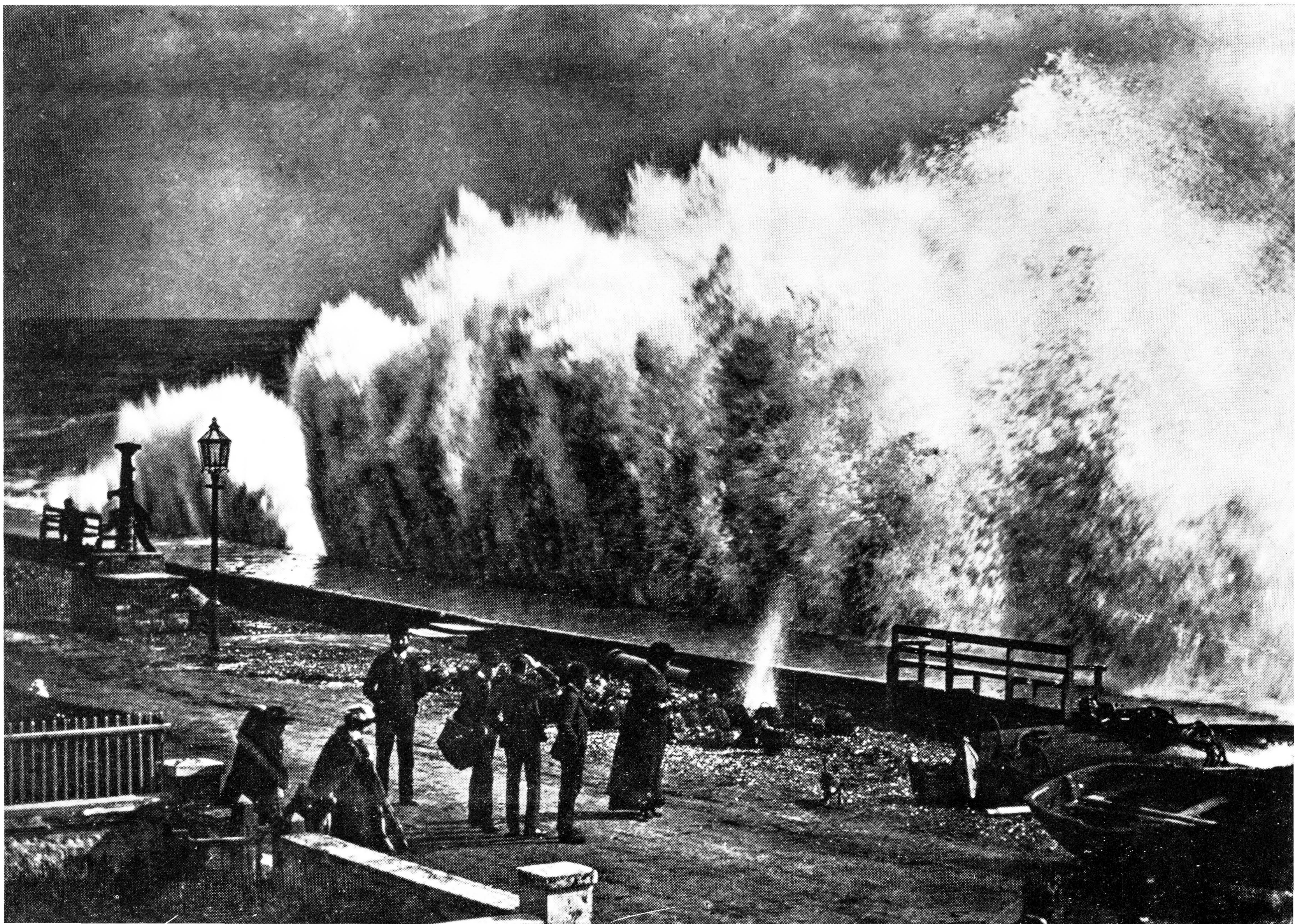


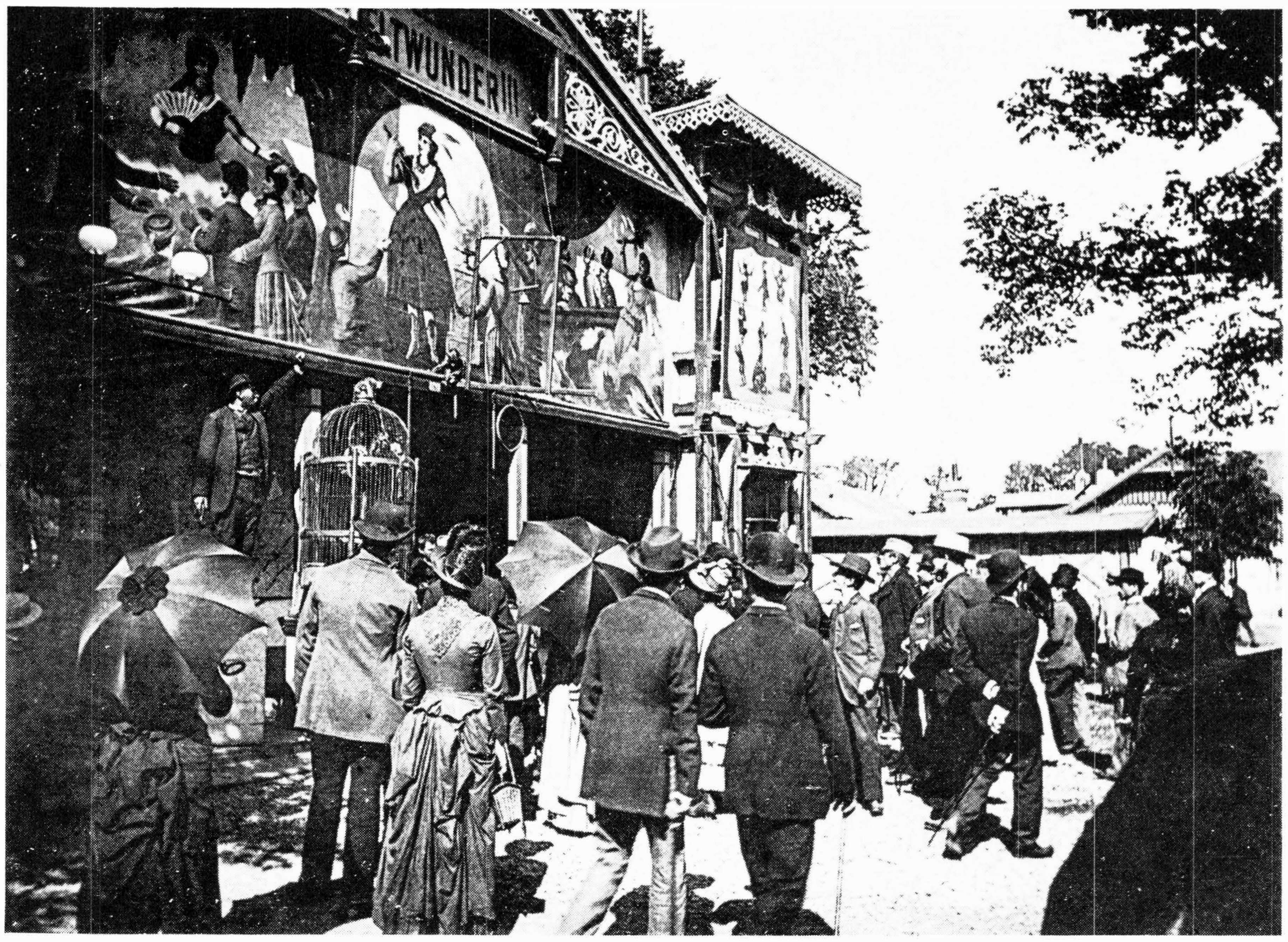
231 ROBERT SLINGSBY. Domestic interior, taken by magnesium light, 1889

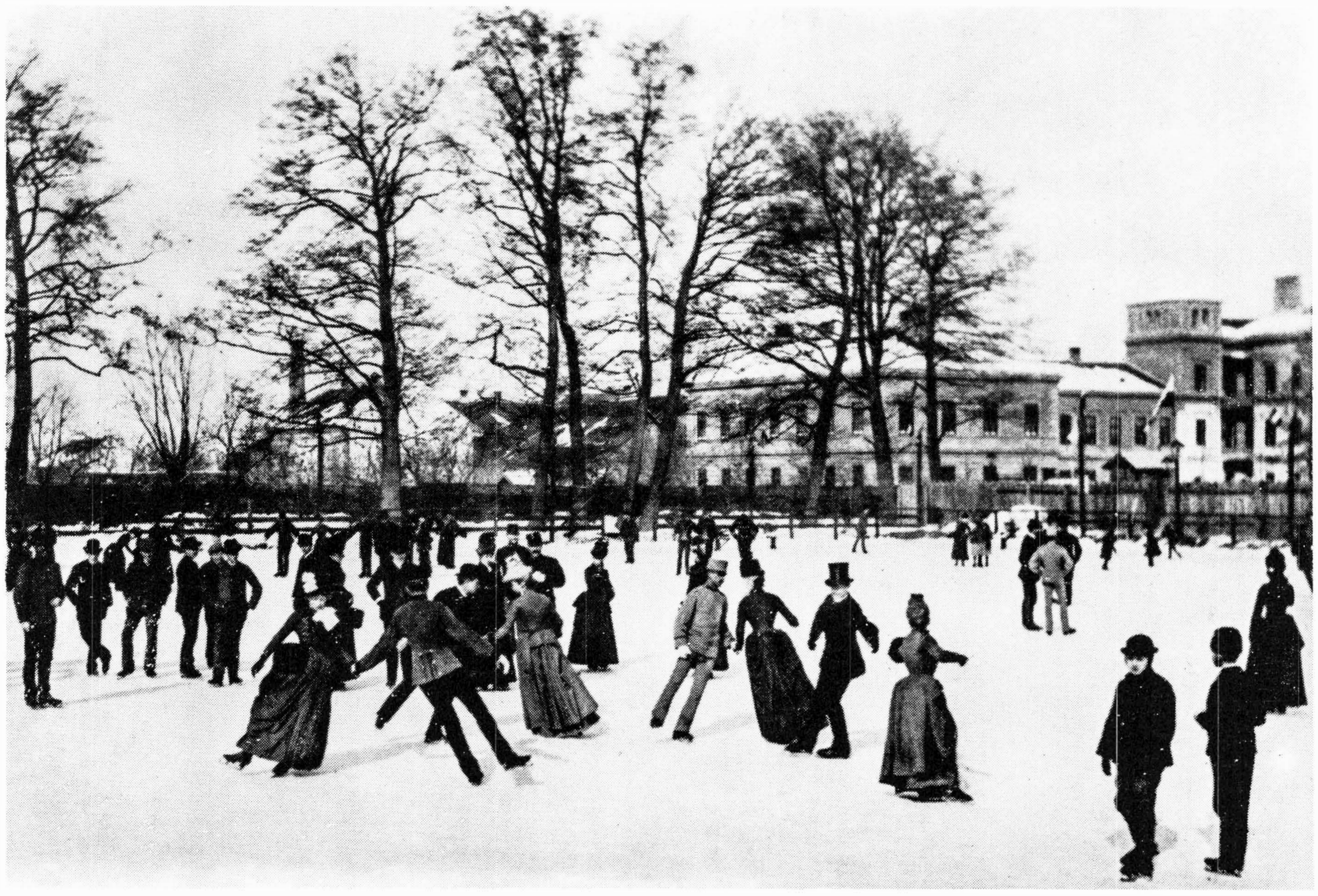
232 HENRY VAN DER WEYDE's electric light studio, *c.* 1880

233 J. BRIDSON. A picnic, *c.* 1882

234 W. P. MARSH. Stormy sea at Bognor, *c.* 1900







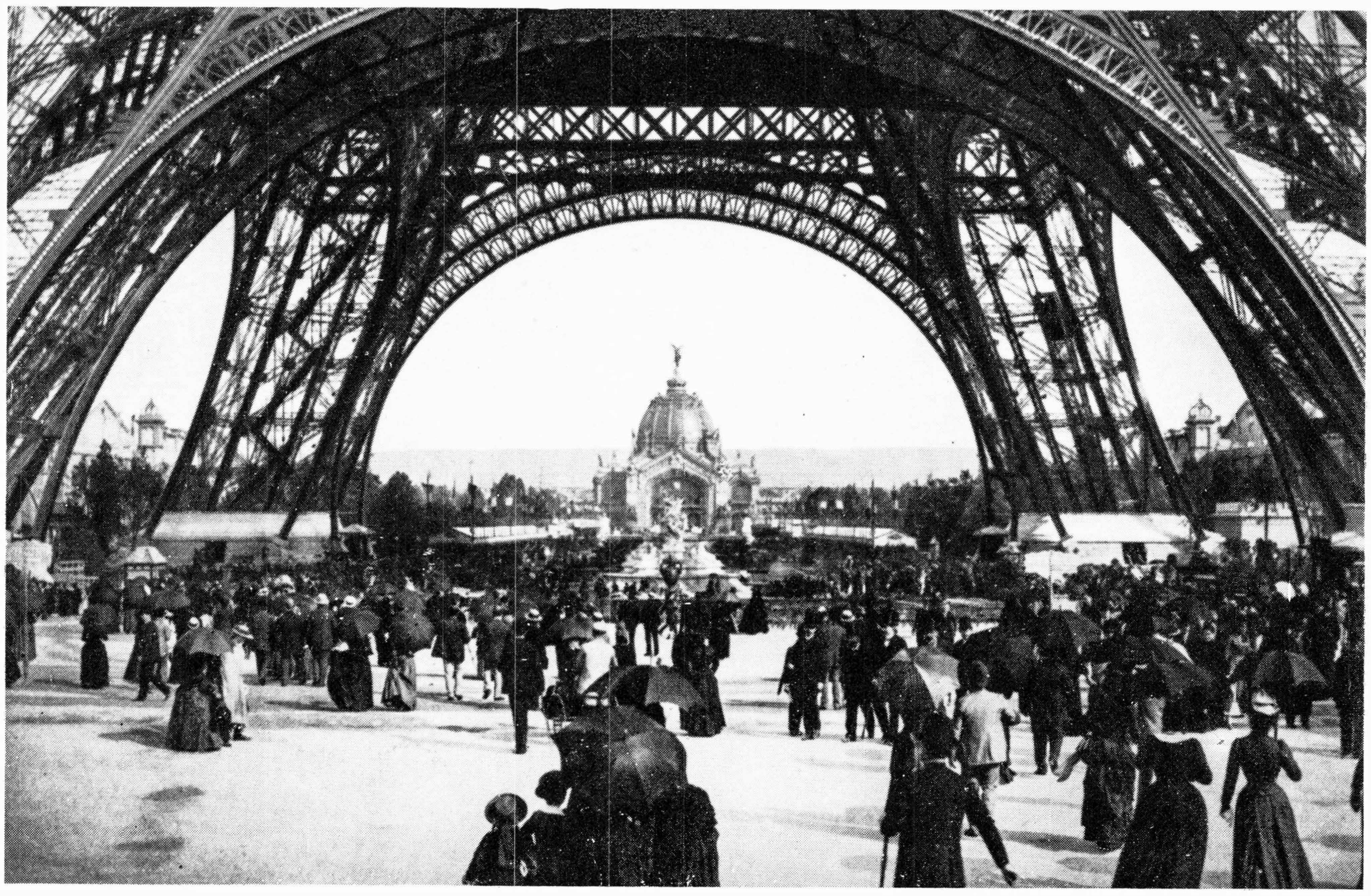
235 VICTOR ANGERER. The Prater, Vienna. Collotype, *c.* 1887

236 OSCAR VAN ZEL. Skating. Collotype, *c.* 1887

237 Unknown photographer. Paris International Exhibition, 1889: at the Eiffel Tower

238 CHARLES A. WILSON. Oxford Street, 1885–7

239 London Stereoscopic Company. The Strand, *c.* 1890



BRASHER
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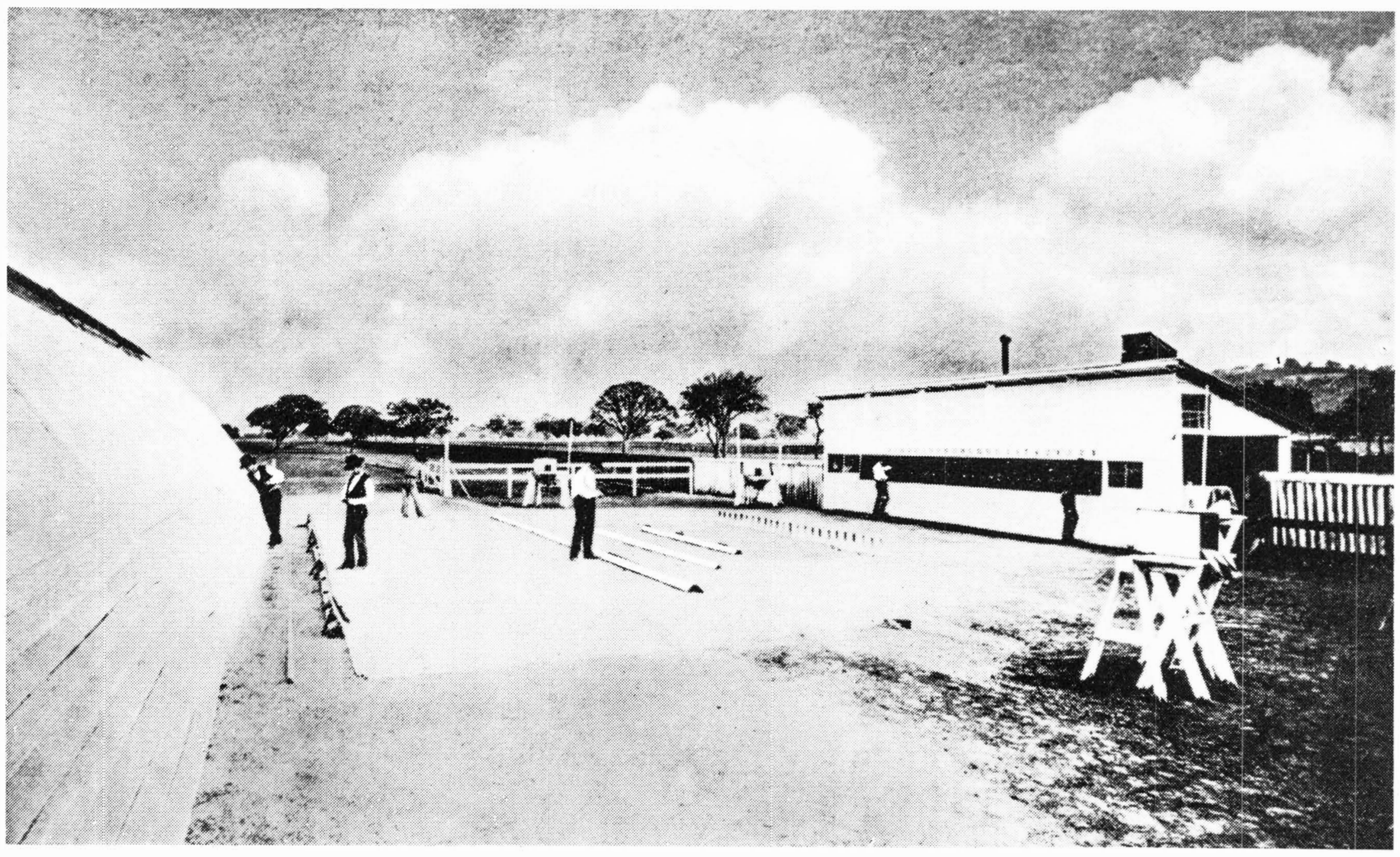
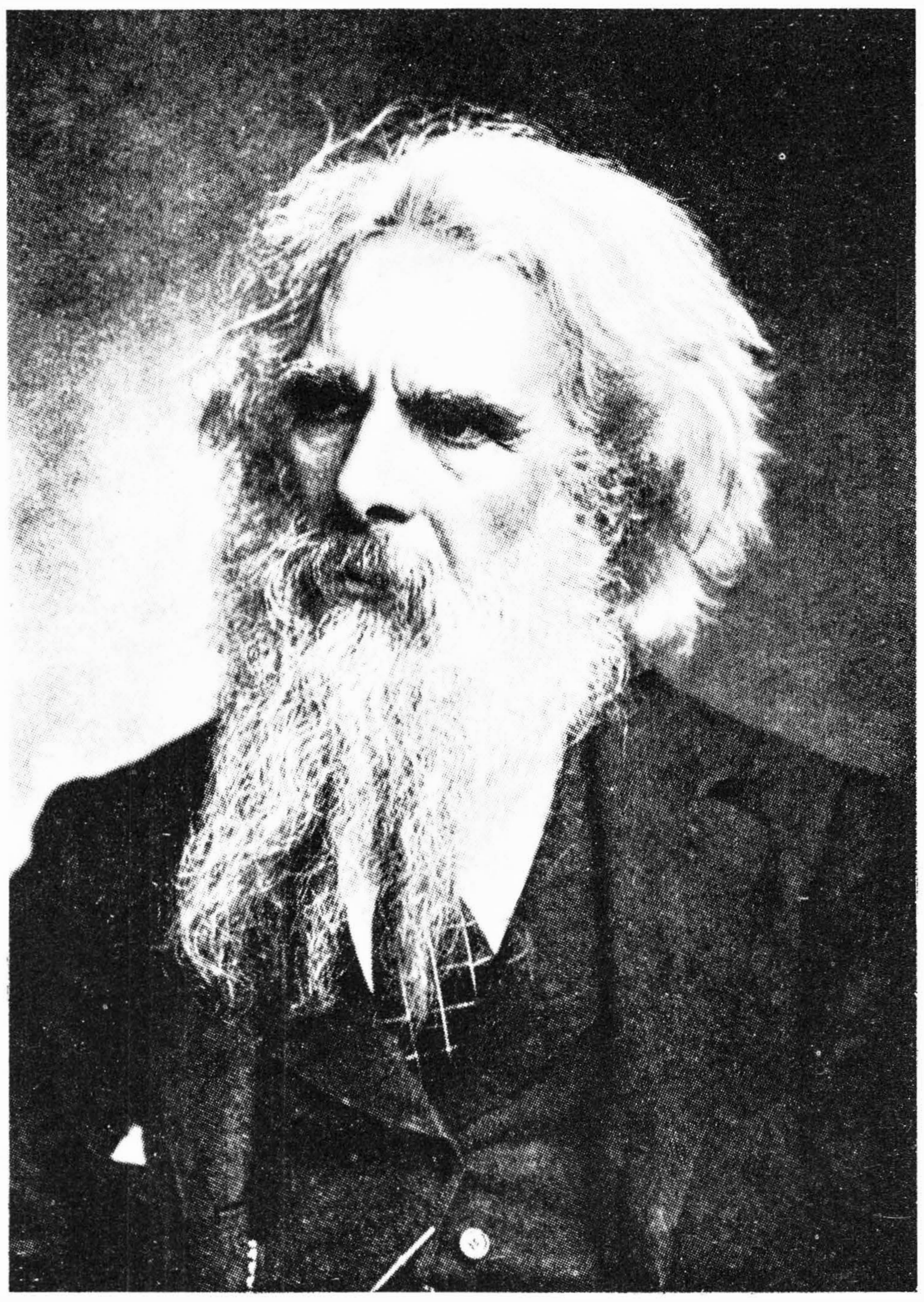
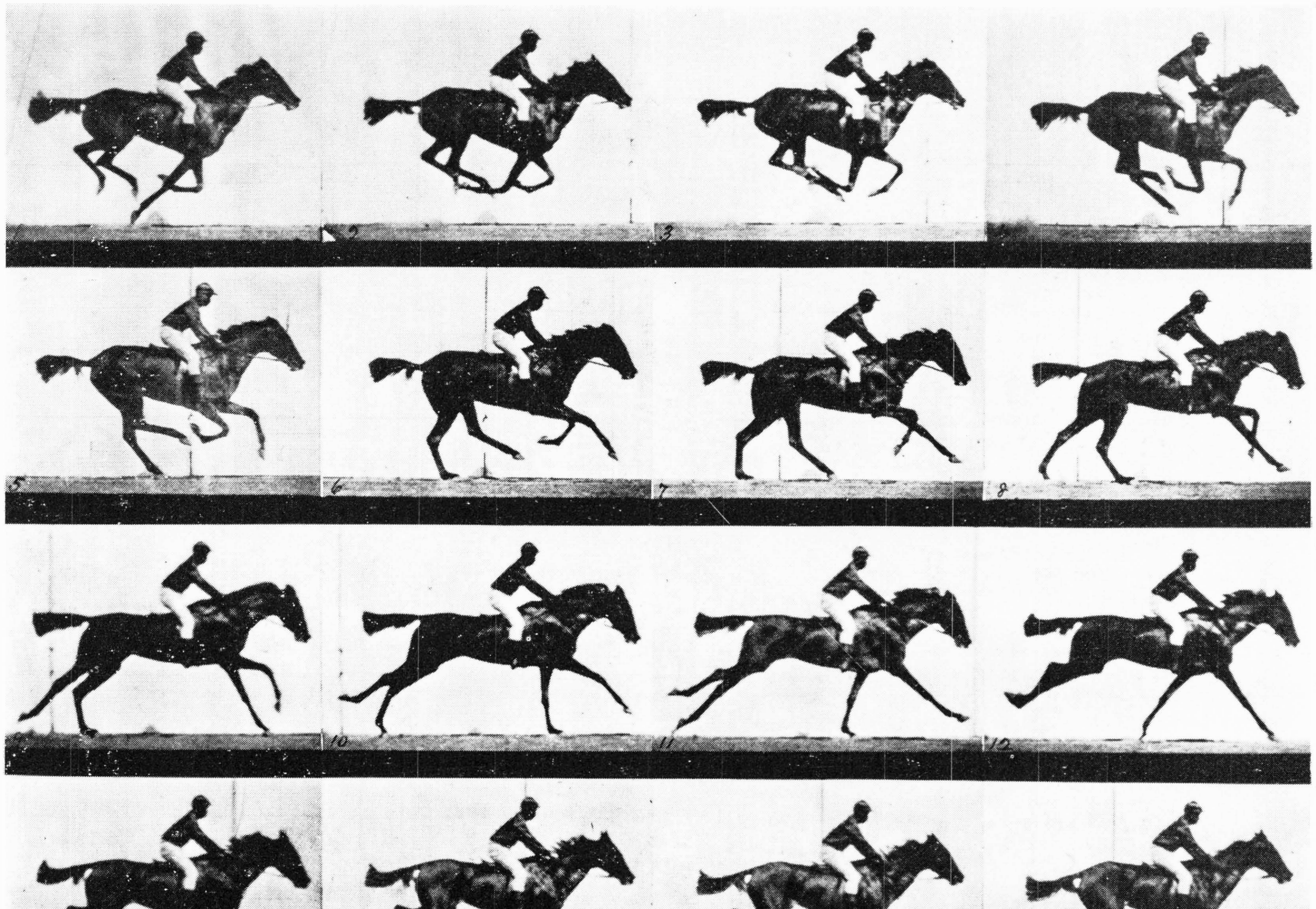
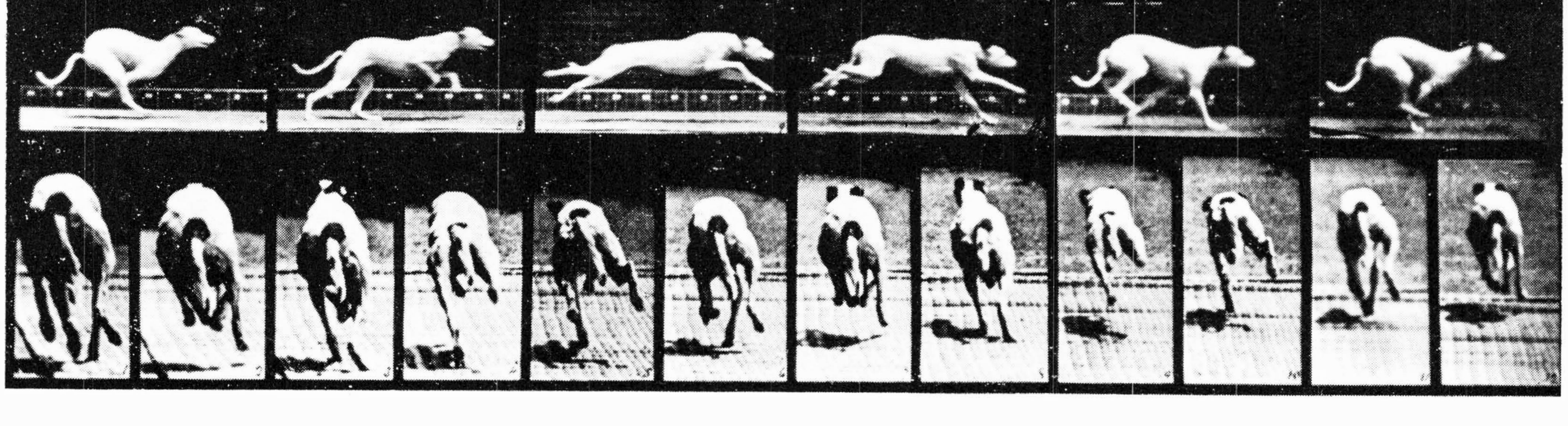






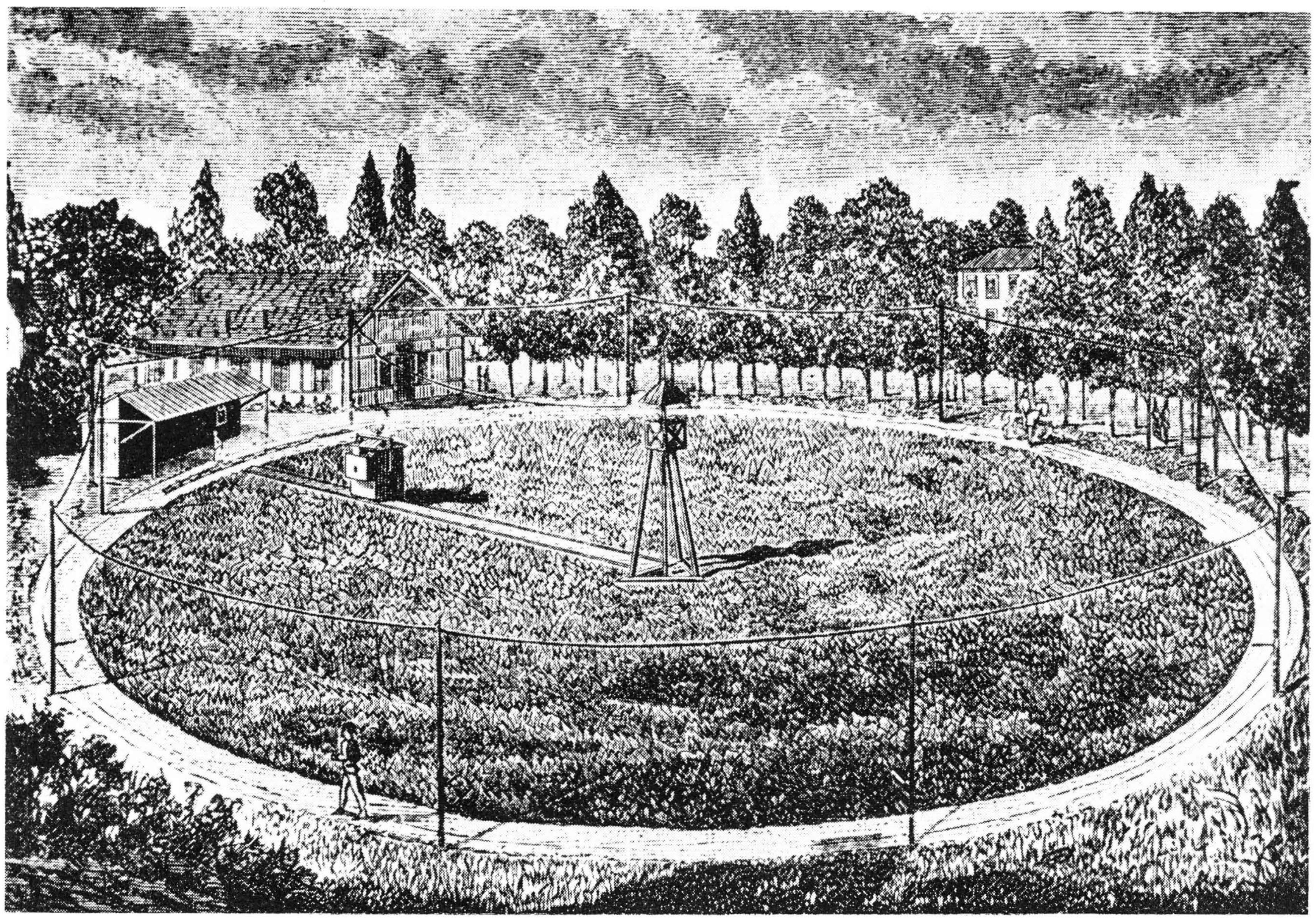


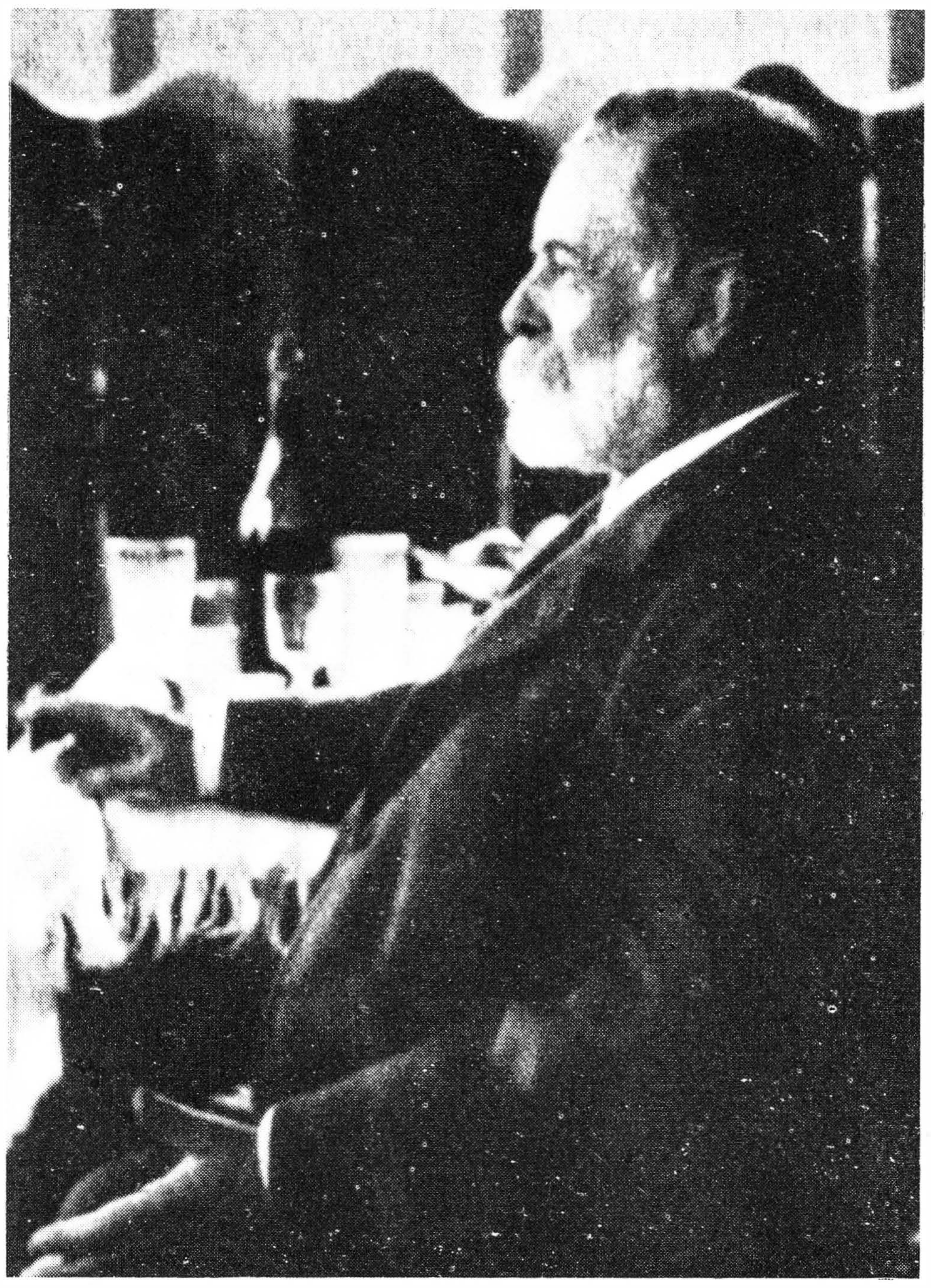
240 MUYBRIDGE's track at Palo Alto, 1879. Heliotype from *The Horse in Motion* by J. D. B. Stillman, 1882

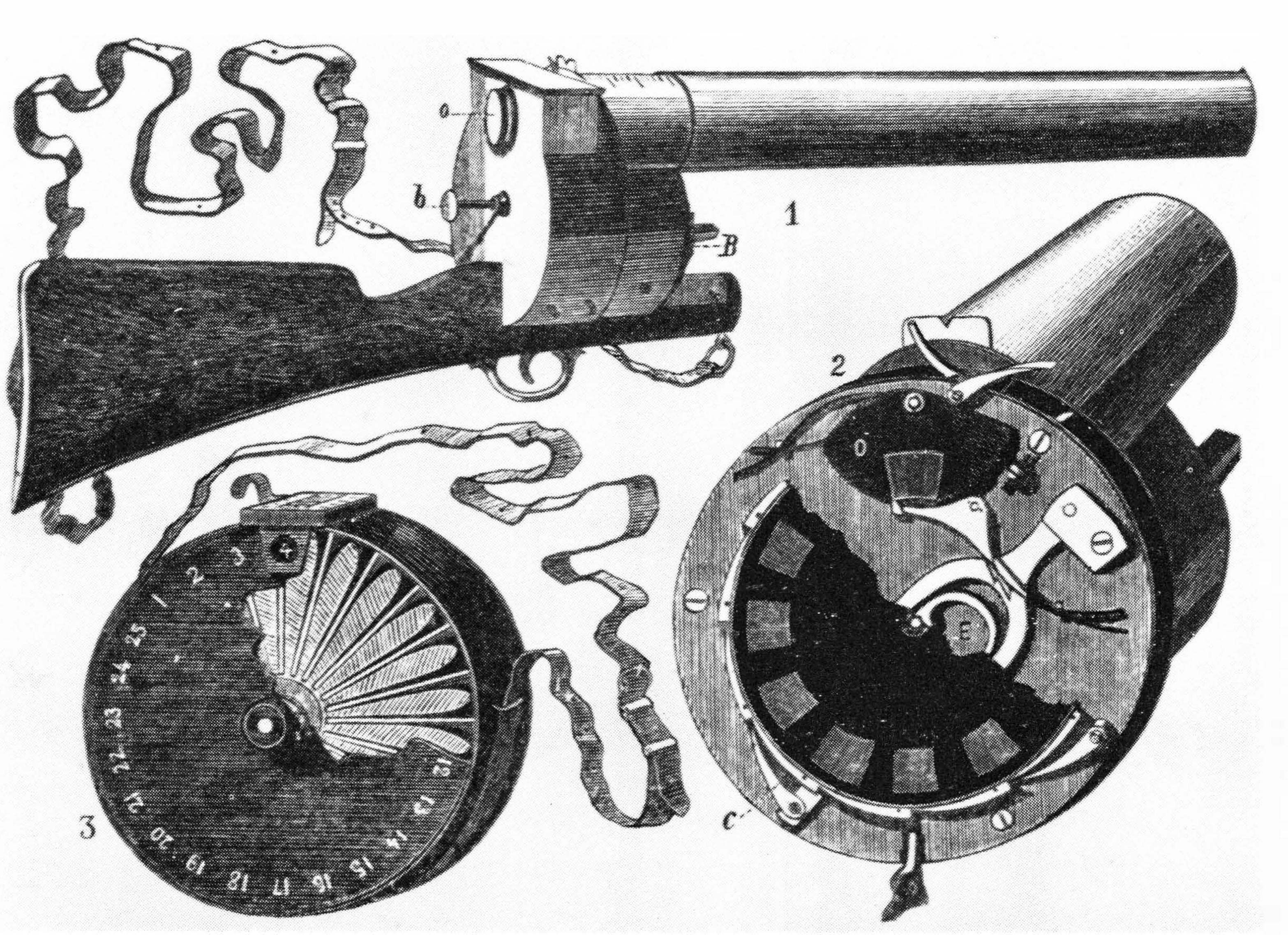
241 EADWEARD MUYBRIDGE, portrait by an unknown photographer, *c.* 1900

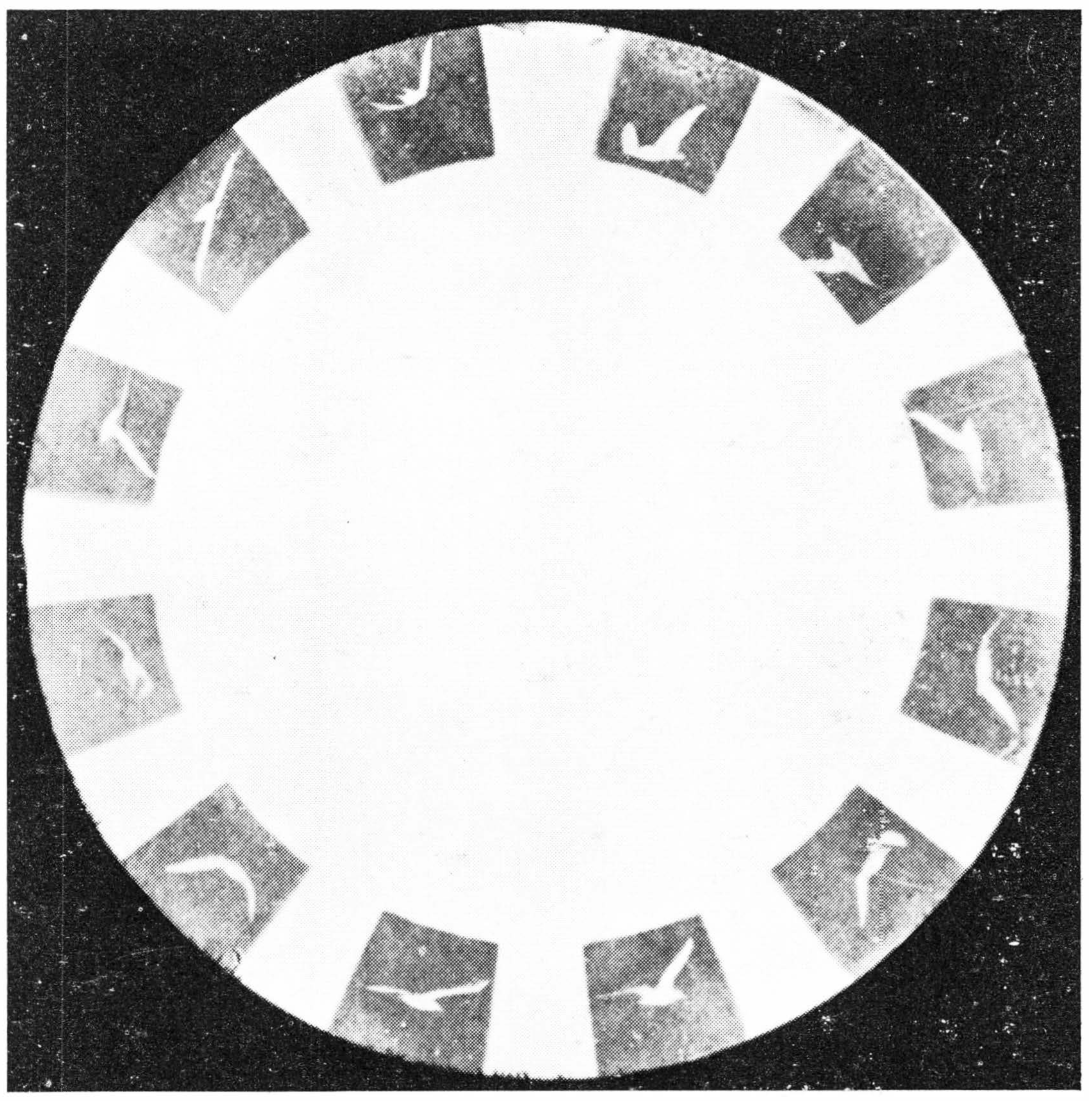
242 E. MUYBRIDGE. Racehorse. Photogravure, 1884–5

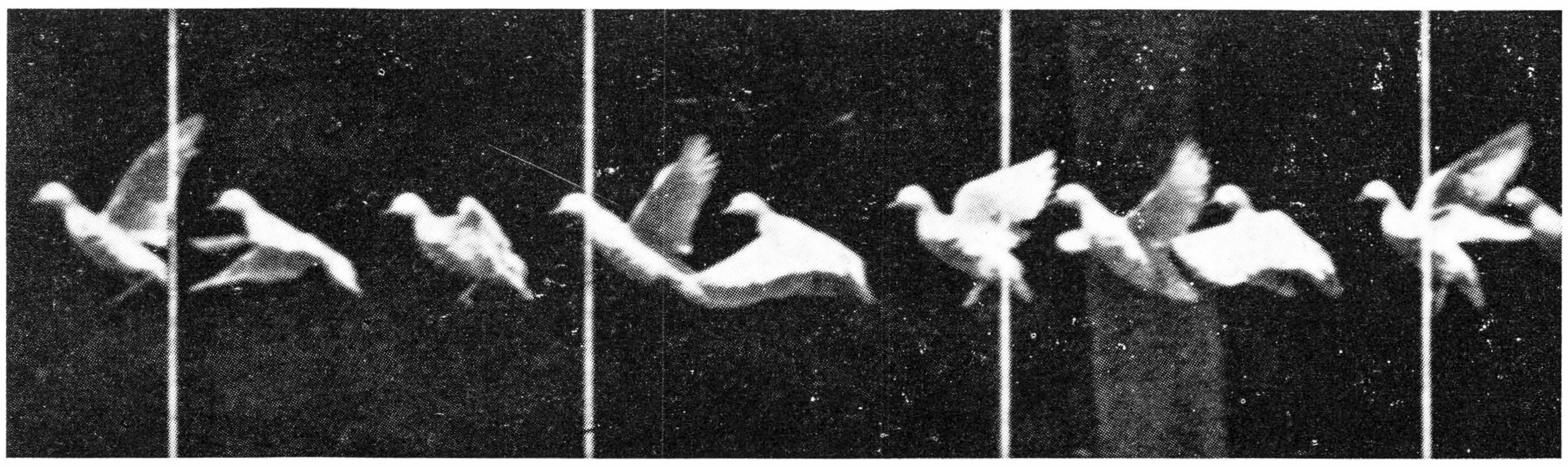
243 E. MUYBRIDGE. Greyhound. Photogravure, 1884–5

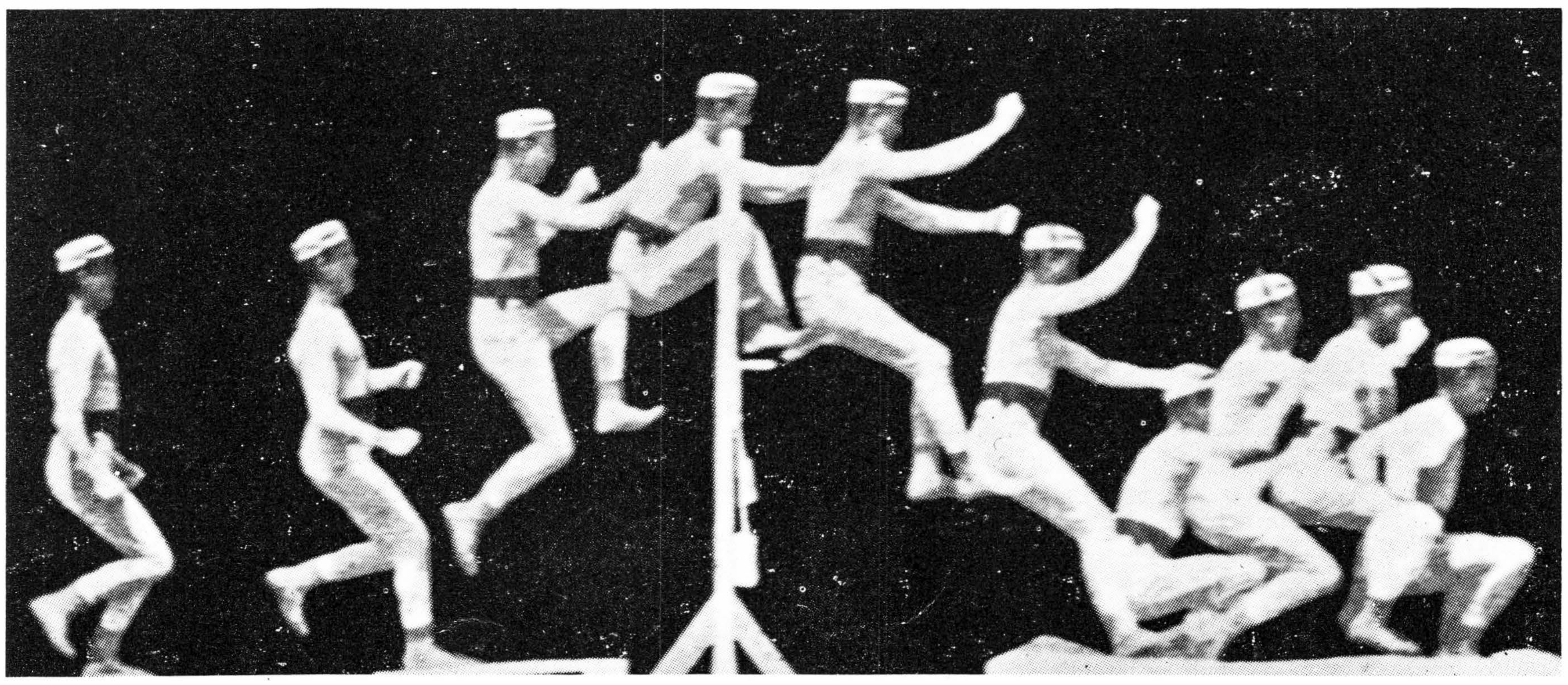










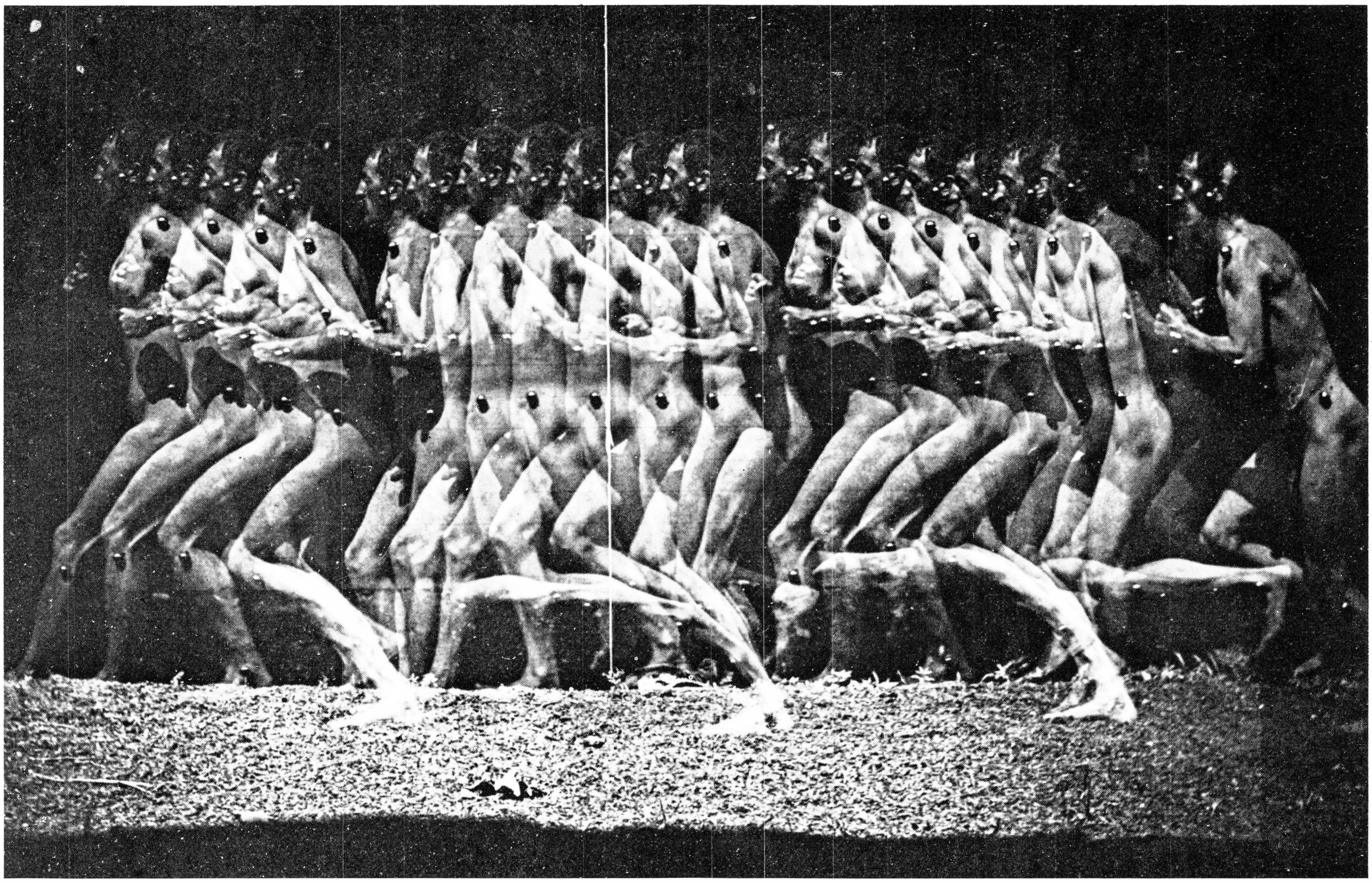


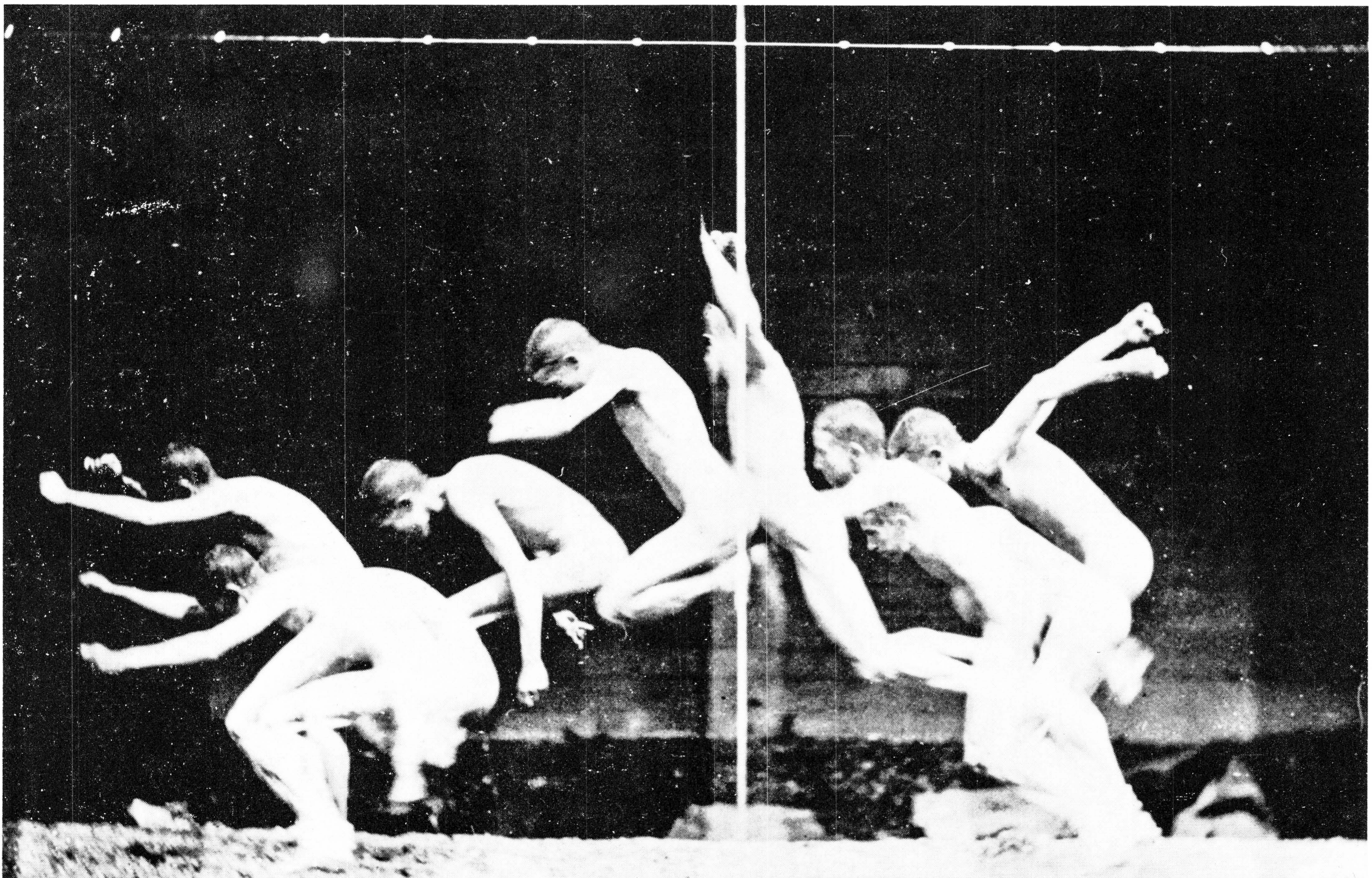
244 E. J. MAREY's arrangement for chronophotography at the Physiological Station, Bois de Boulogne, Paris, 1882

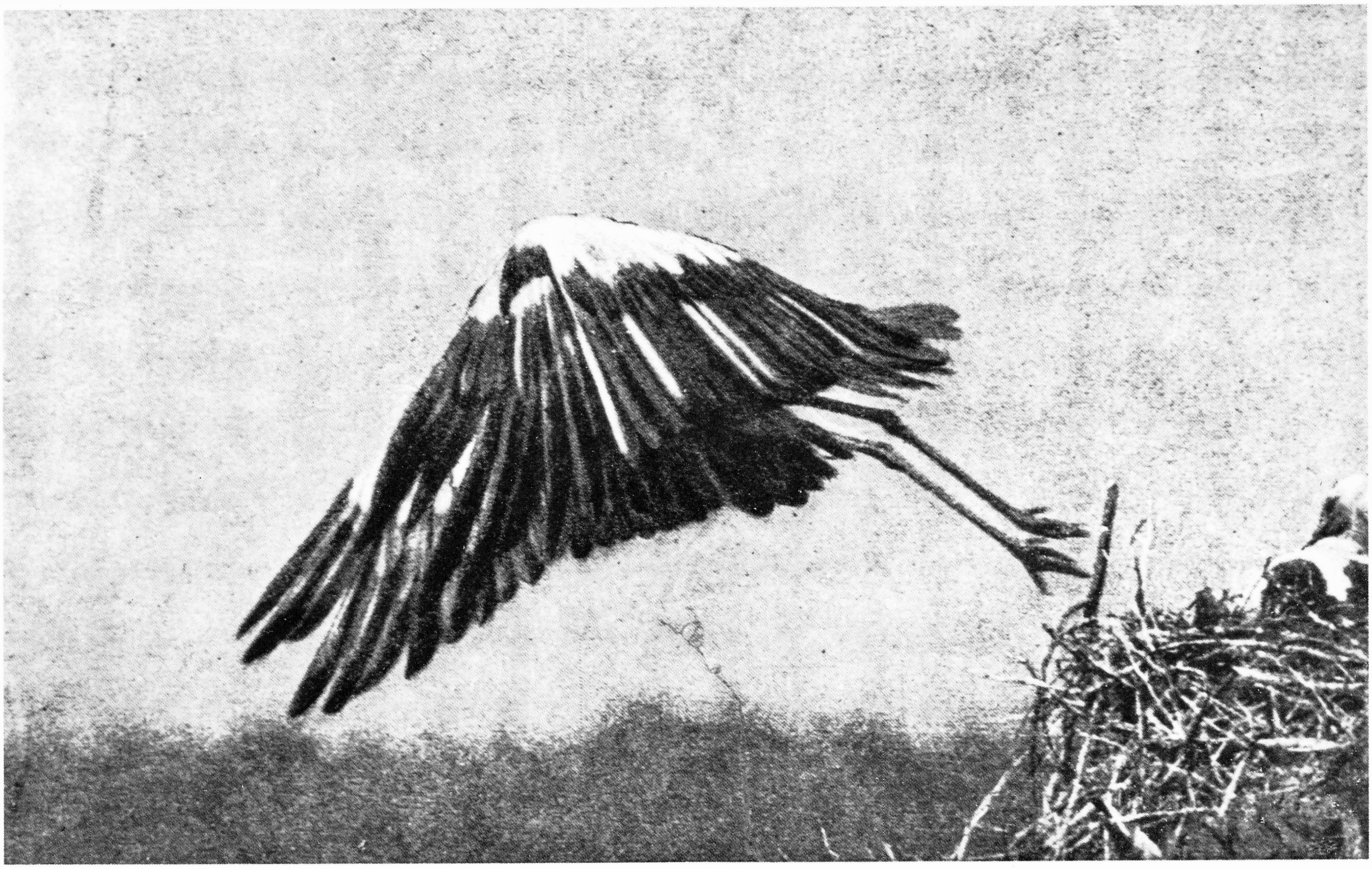
245 PROFESSOR E. J. MAREY, *c.* 1890

246, 247 E. J. MAREY's photographic gun, and circular plate showing a gull flying taken with photographic gun, 1882

248, 249 E. J. MAREY. Duck flying and man jumping, *c.* 1882







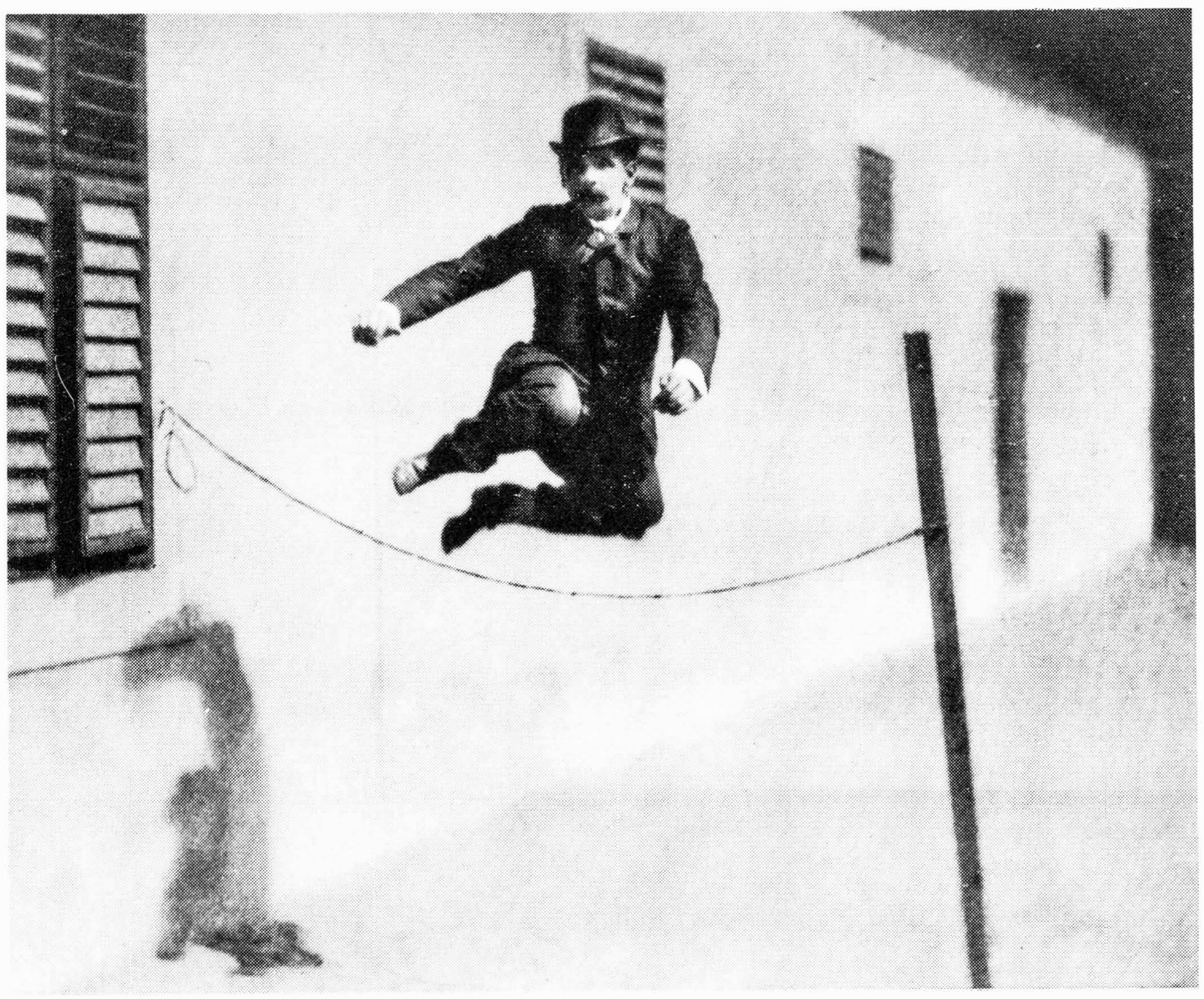
250 THOMAS EAKINS. Man running, 1884–5

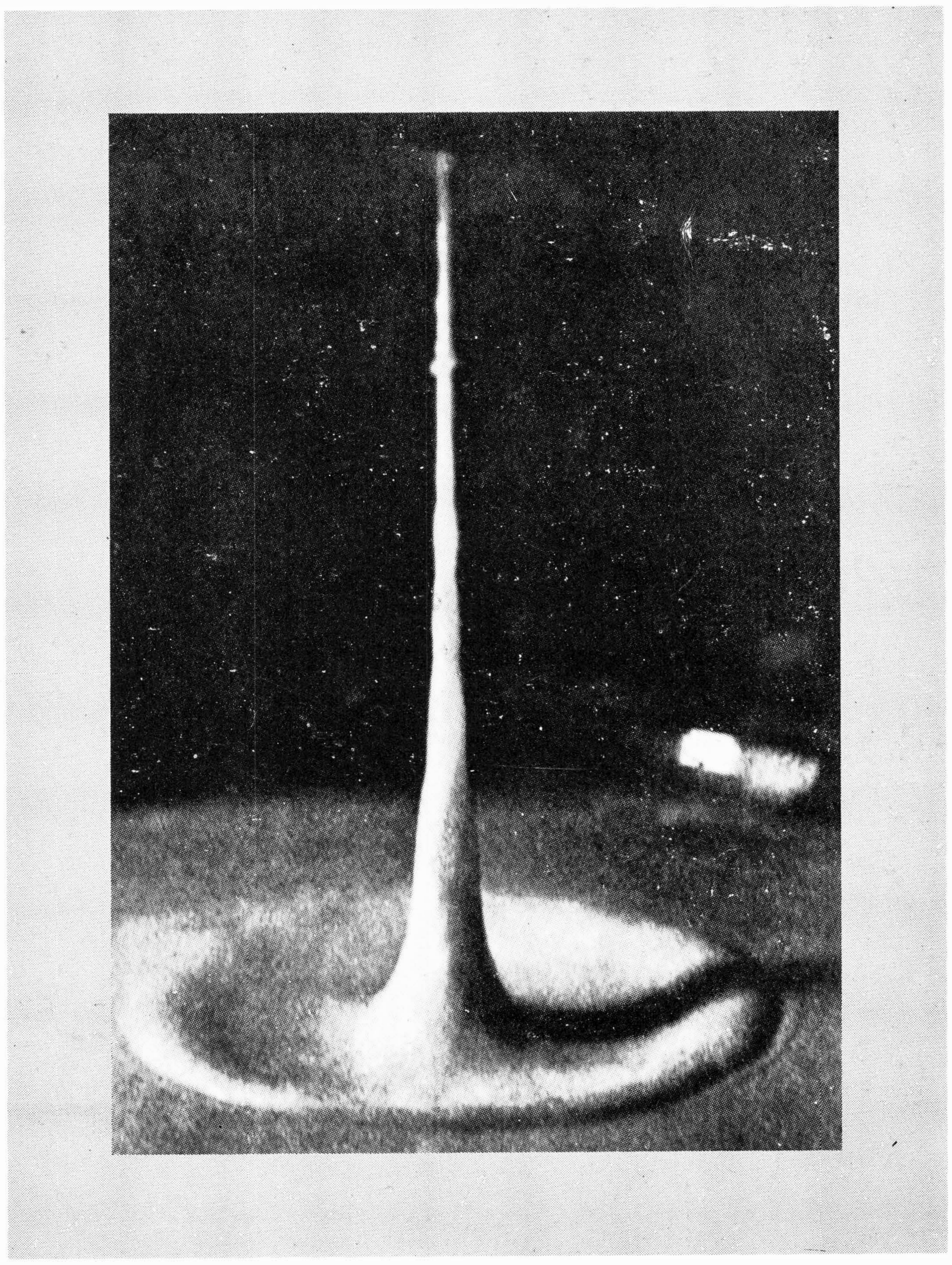
251 THOMAS EAKINS. Boy jumping, 1884–5

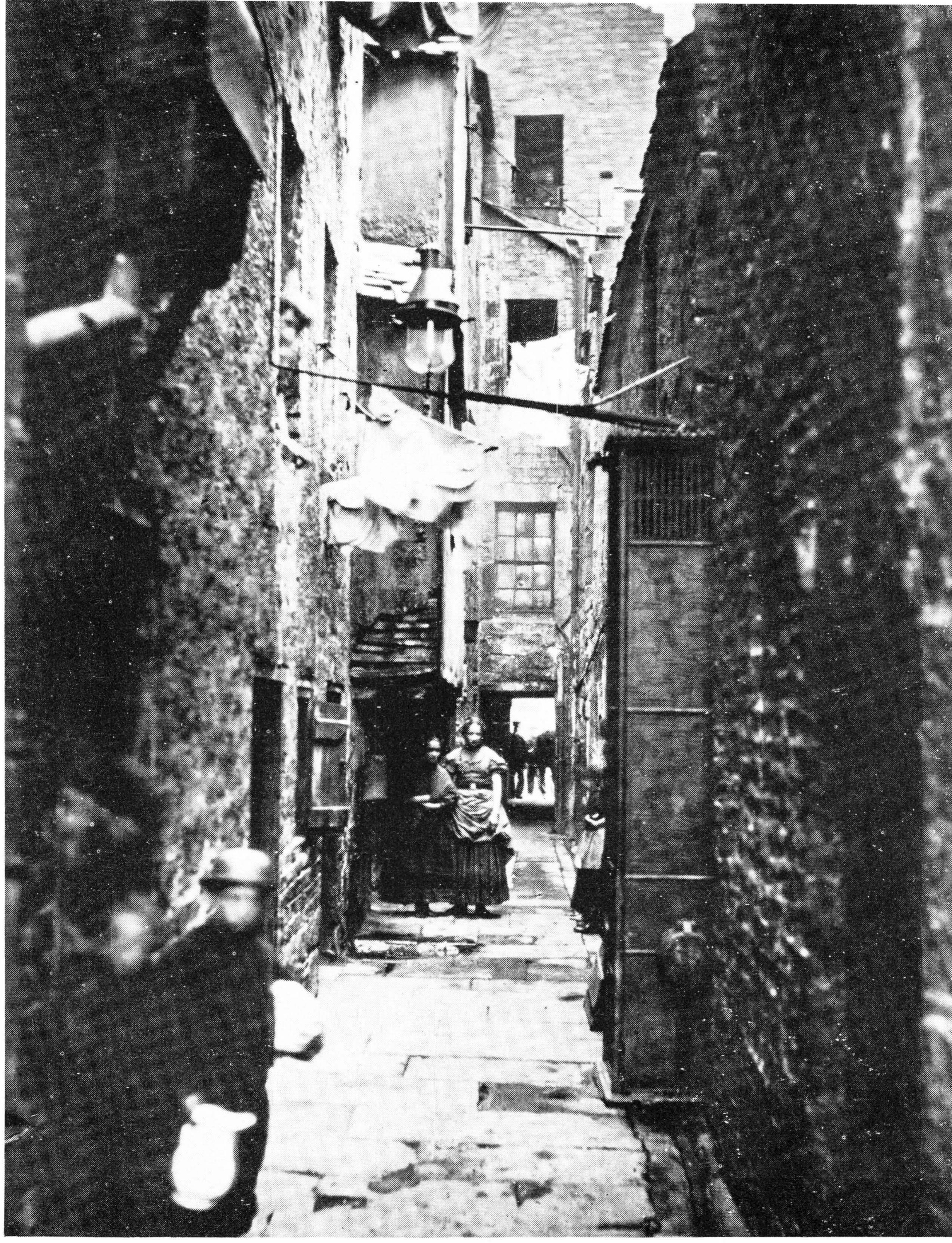
252 OTTOMAR ANSCHÜTZ. Stork leaving nest, 1884. Reproduction

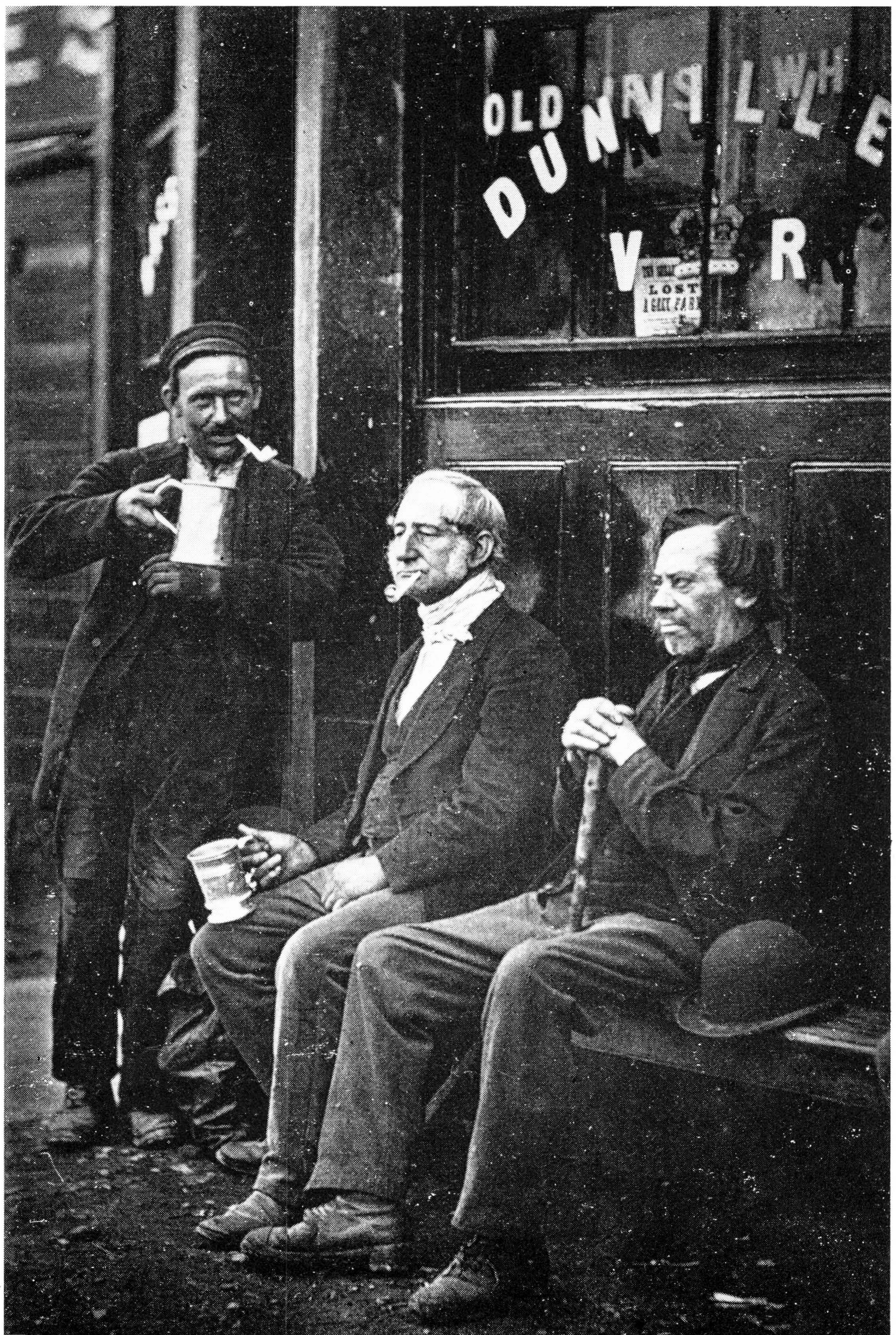
253 COUNT ESTERHAZY. Count Rinsky jumping. Collotype, c. 1885

254 A. M. WORTHINGTON. A milk splash caused by a falling ball, c. 1900. Reproduction





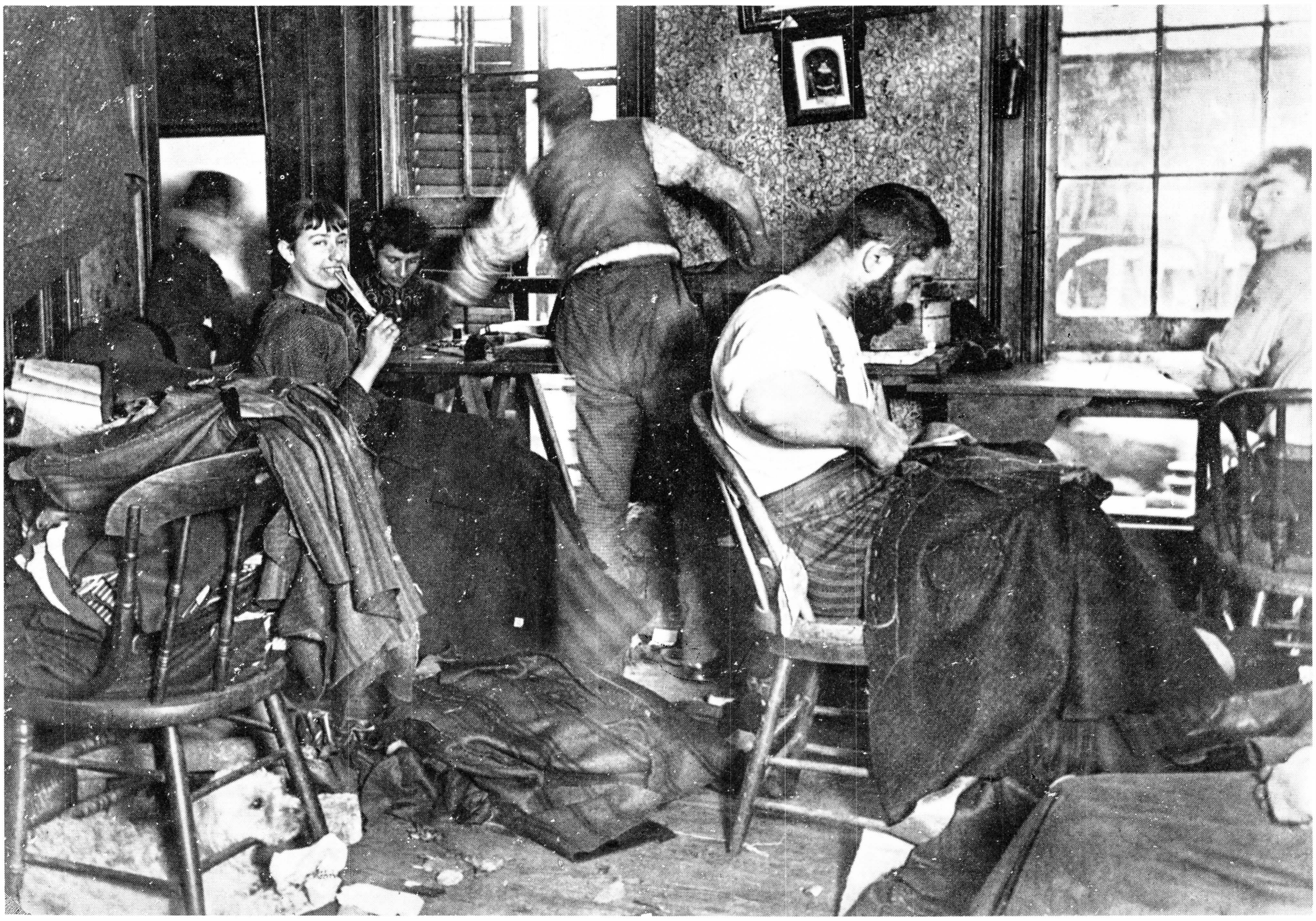




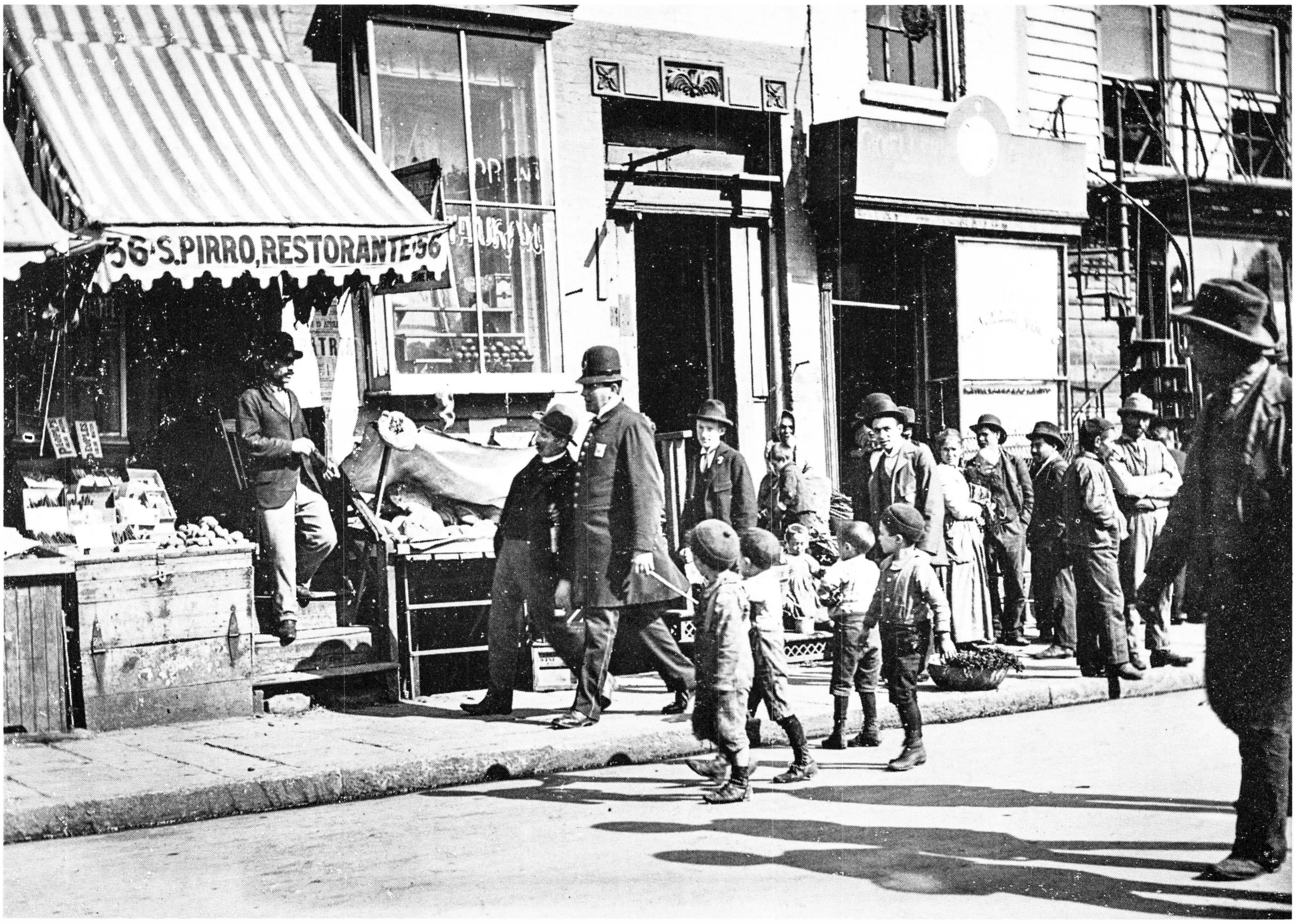
255 JOHN THOMSON. Old woman with baby. Woodburytype, 1876–7

256 THOMAS ANNAN. Slums in Glasgow, 1868

257 JOHN THOMSON. Outside the pub, London. Woodburytype, 1876



258 JACOB RIIS. Tailor's workshop employing sweated labour, New York, 1888
259 Unknown photographer. Arrest of a 'hobo', New York, 1897
260 LEWIS WICKES HINE. Italian immigrant family, Ellis Island, 1905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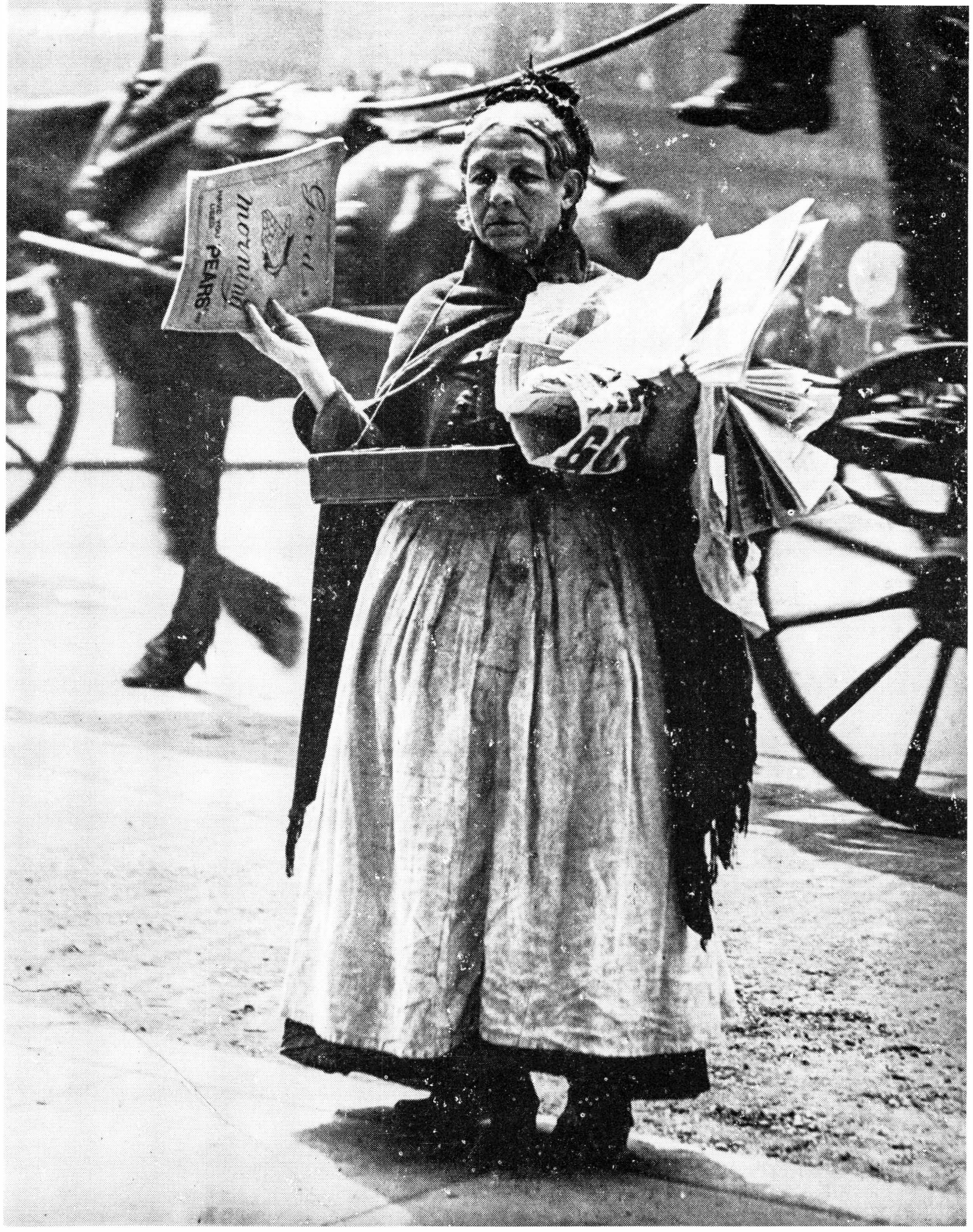
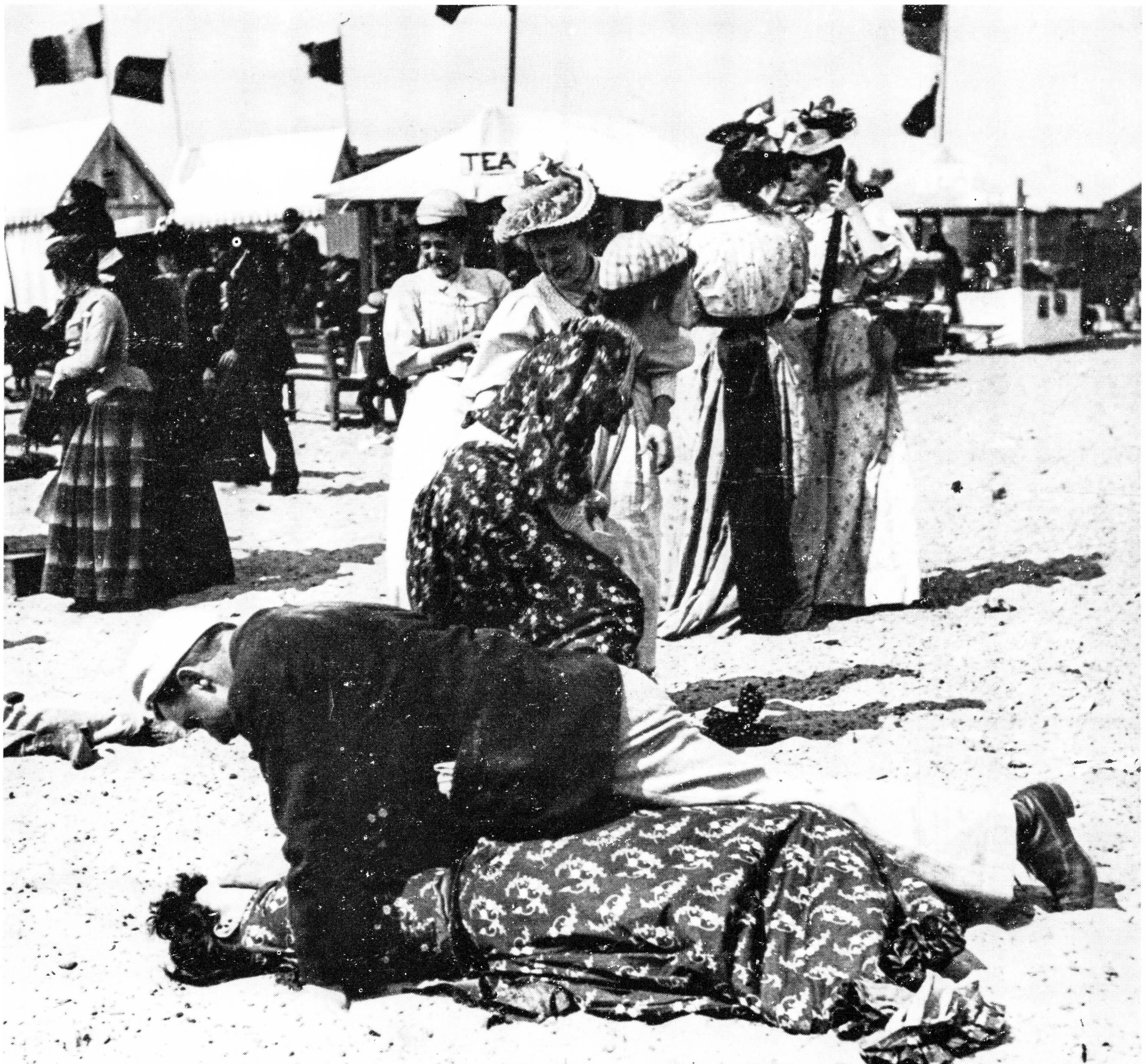


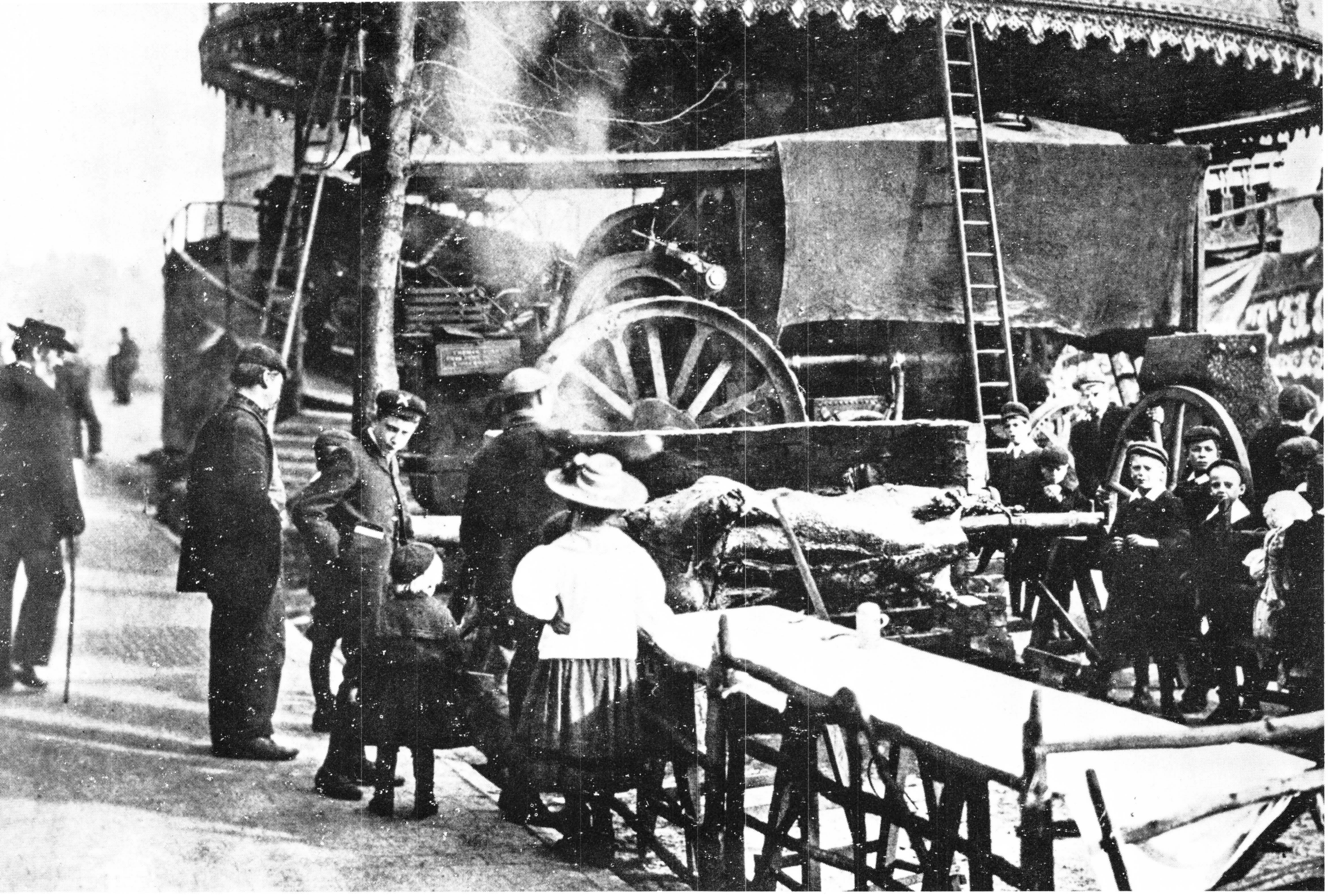
261 ARNOLD GENTHE. Emergency feeding of homeless people after the San Francisco earthquake, 1906

262 NAHUM LUBOSHEZ. Famine in Russia, 1910

263 PAUL MARTIN. Street vendor, London, 1892–4

264 PAUL MARTIN. Yarmouth beach, 1892



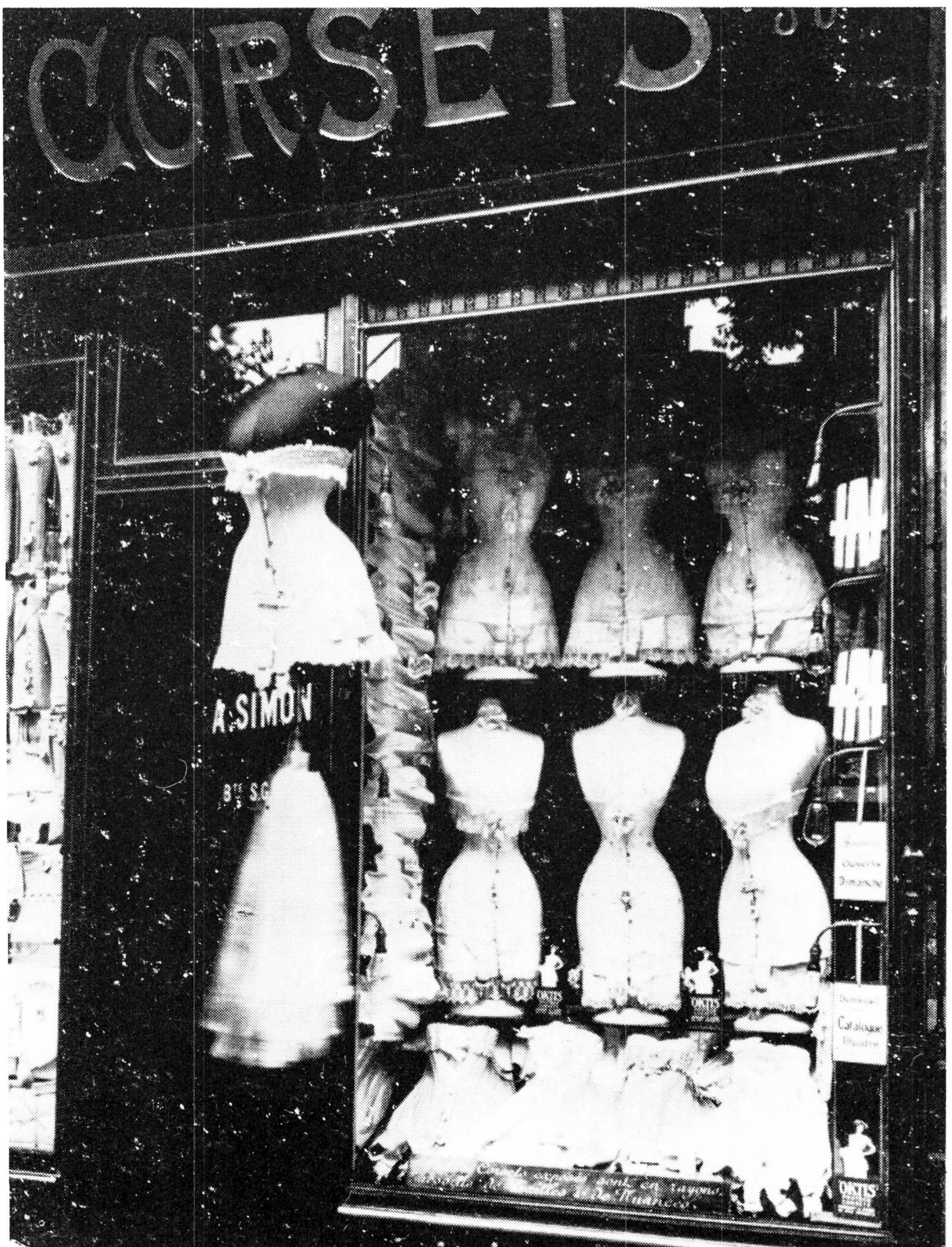


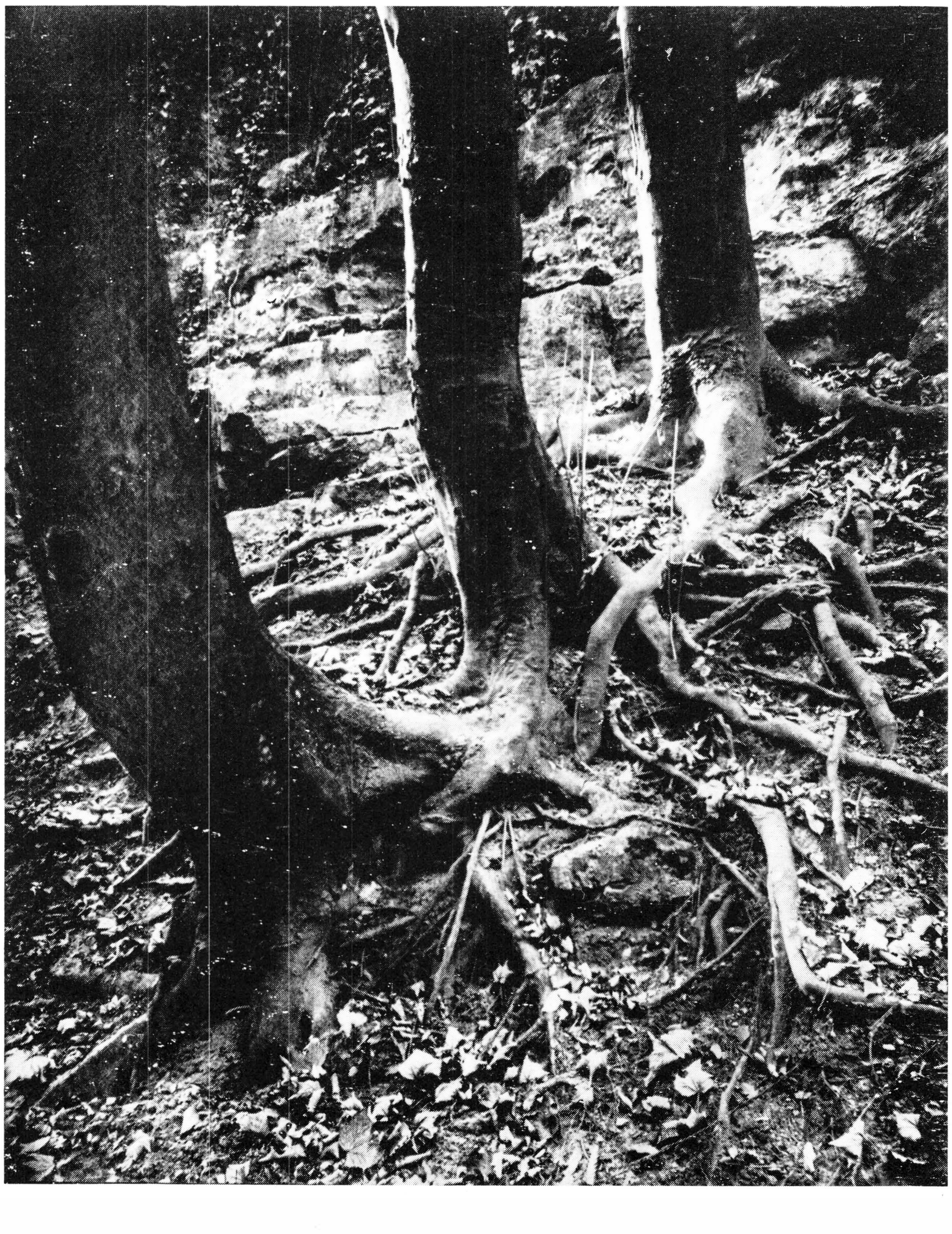
265 SIR BENJAMIN STONE. Ox-roasting at Stratford-on-Avon 'Mop', *c.* 1898

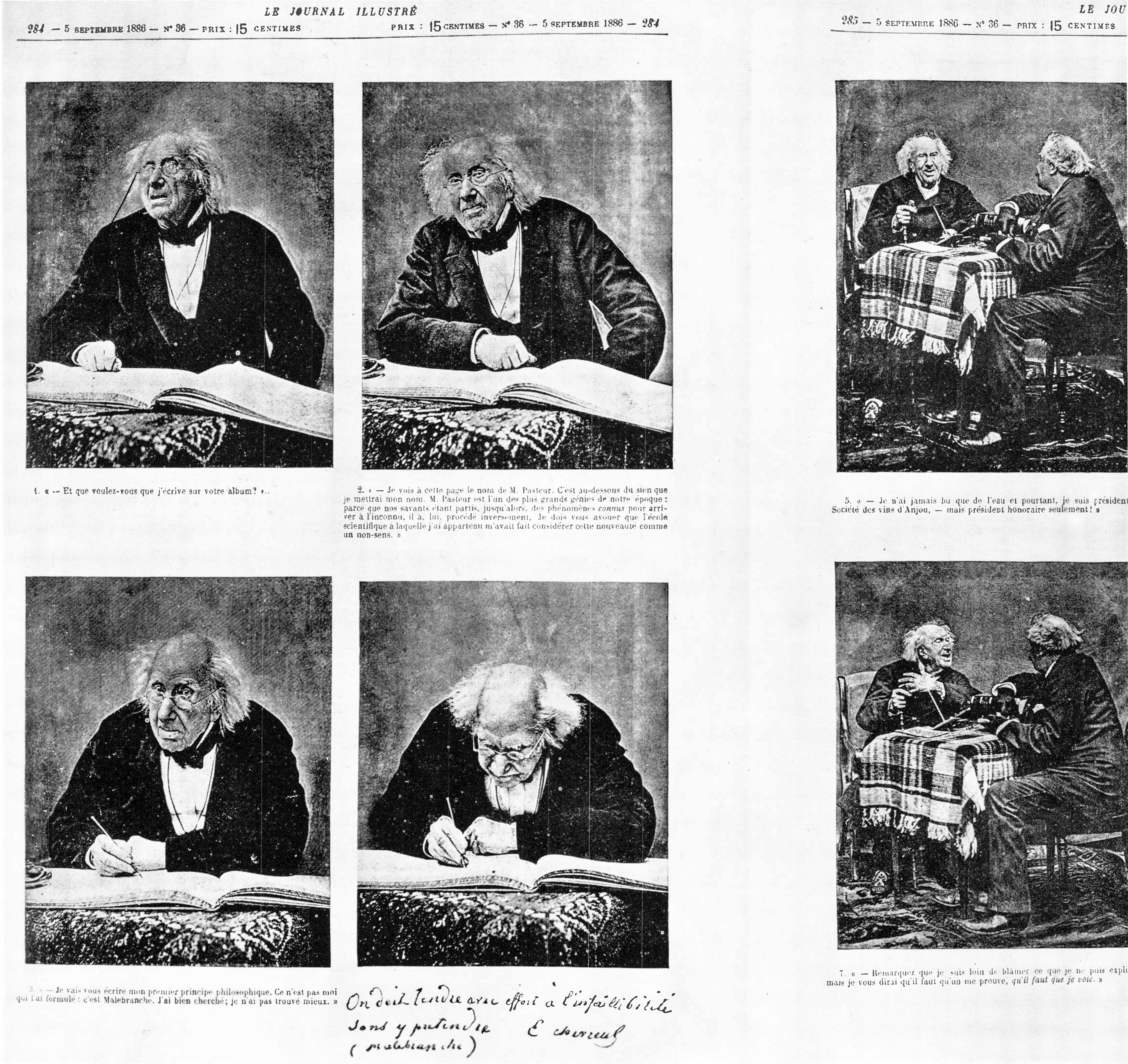
266 EUGÈNE ATGET. Corset shop, Paris, *c.* 1908

267 EUGÈNE ATGET. Tree roots at St Cloud, *c.* 1900

268 HERBERT PONTING. The *Terra Nova* in the Antarctic, 1912







LE JOURNAL ILLUSTRÉ

284 — 5 SEPTEMBRE 1886 — N° 36 — PRIX : 15 CENTIMES   PRIX : 15 CENTIMES — N° 36 — 5 SEPTEMBRE 1886 — 284

1. « — Et que voulez-vous que j'écrive sur votre album? »..

2. « — Je vois à cette page le nom de M. Pasteur. C'est au-dessous du sien que je mettrai mon nom. M. Pasteur est l'un des plus grands génies de notre époque : parce que nos savants étant partis, jusqu'alors, des phénomènes *connus* pour arriver à l'inconnu, il a, lui, procédé inversement. Je dois vous avouer que l'école scientifique à laquelle j'ai appartenu m'avait fait considérer cette nouveauté comme un non-sens. »

3. « — Je vais vous écrire mon premier principe philosophique. Ce n'est pas moi qui l'ai formulé : c'est Malebranche. J'ai bien cherché; je n'ai pas trouvé mieux. »

On doit tendre avec effort à l'infaillibilité
sans y prétendre   E Chevreul
(malebranche)

LE JOU

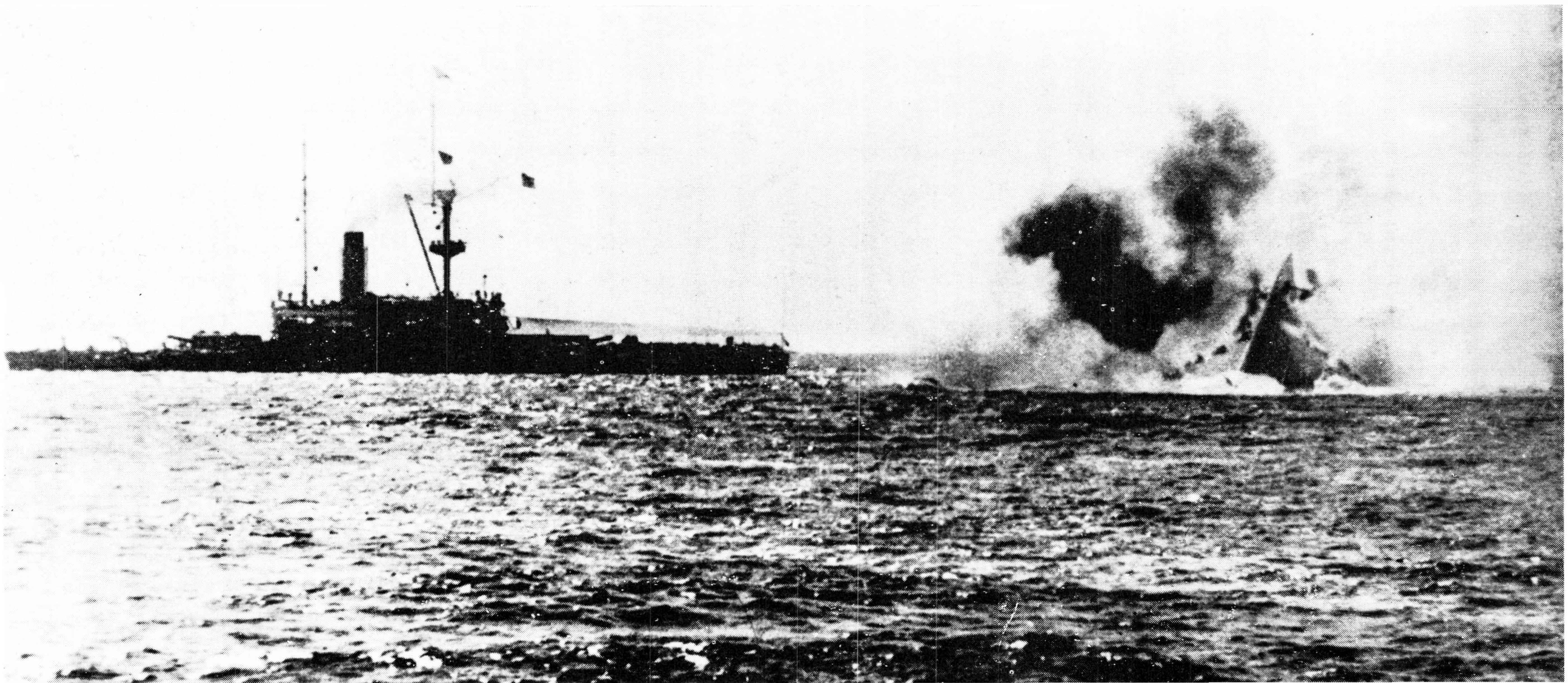
285 — 5 SEPTEMBRE 1886 — N° 36 — PRIX : 15 CENTIMES

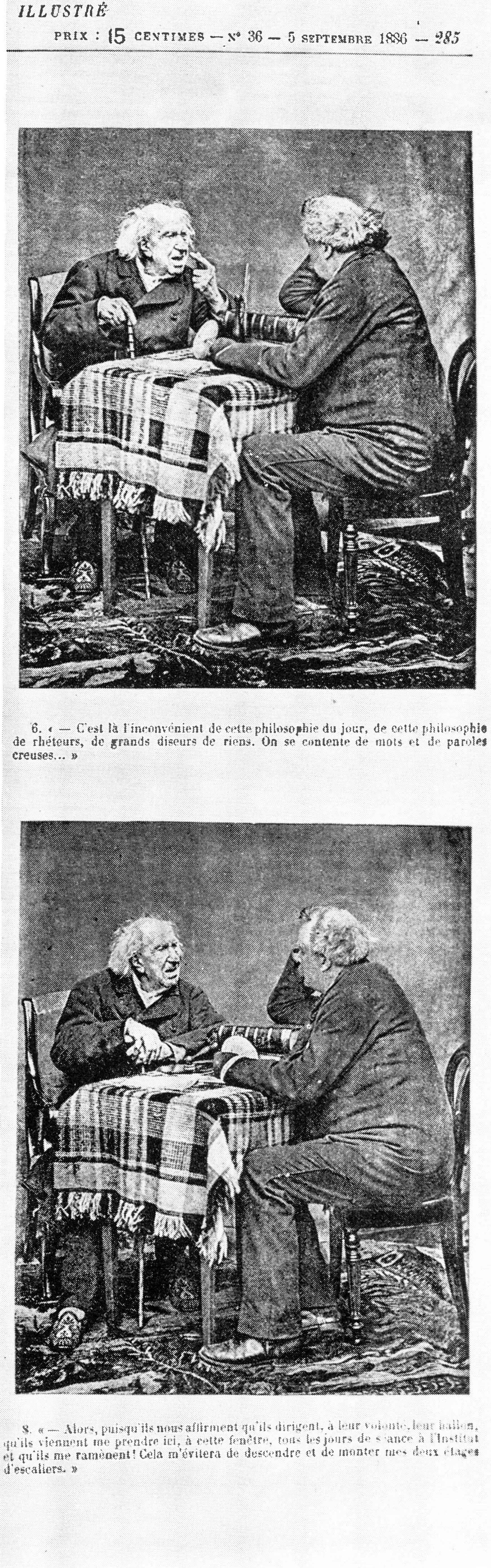
5. « — Je n'ai jamais bu que de l'eau et pourtant, je suis présiden
Société des vins d'Anjou, — mais président honoraire seulement! »

7. « — Remarquez que je suis loin de blâmer ce que je ne puis expli
mais je vous dirai qu'il faut qu'on me prouve, qu'il *faut que je voie.* »

269 PAUL NADAR. The first photo-interview (with Michel Eugène Chevreul), two pages from *Le Journal Illustré*, Paris, 5 September 1886

270 H.M.S. *Victoria* sinking after being in collision with H.M.S. *Camperdown* off Tripoli, 22 June 1893. Photograph by Staff-Surgeon COLLOT



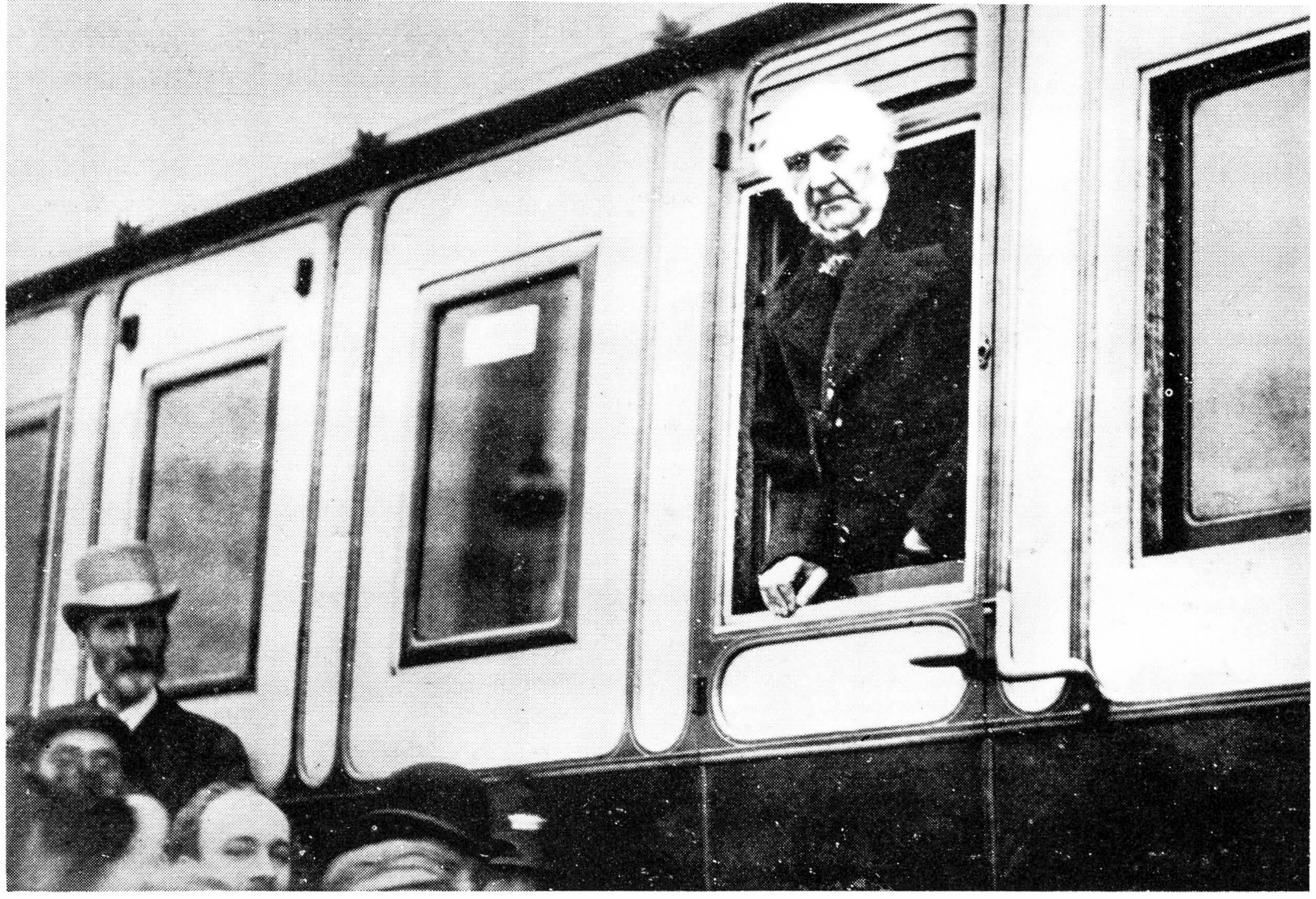


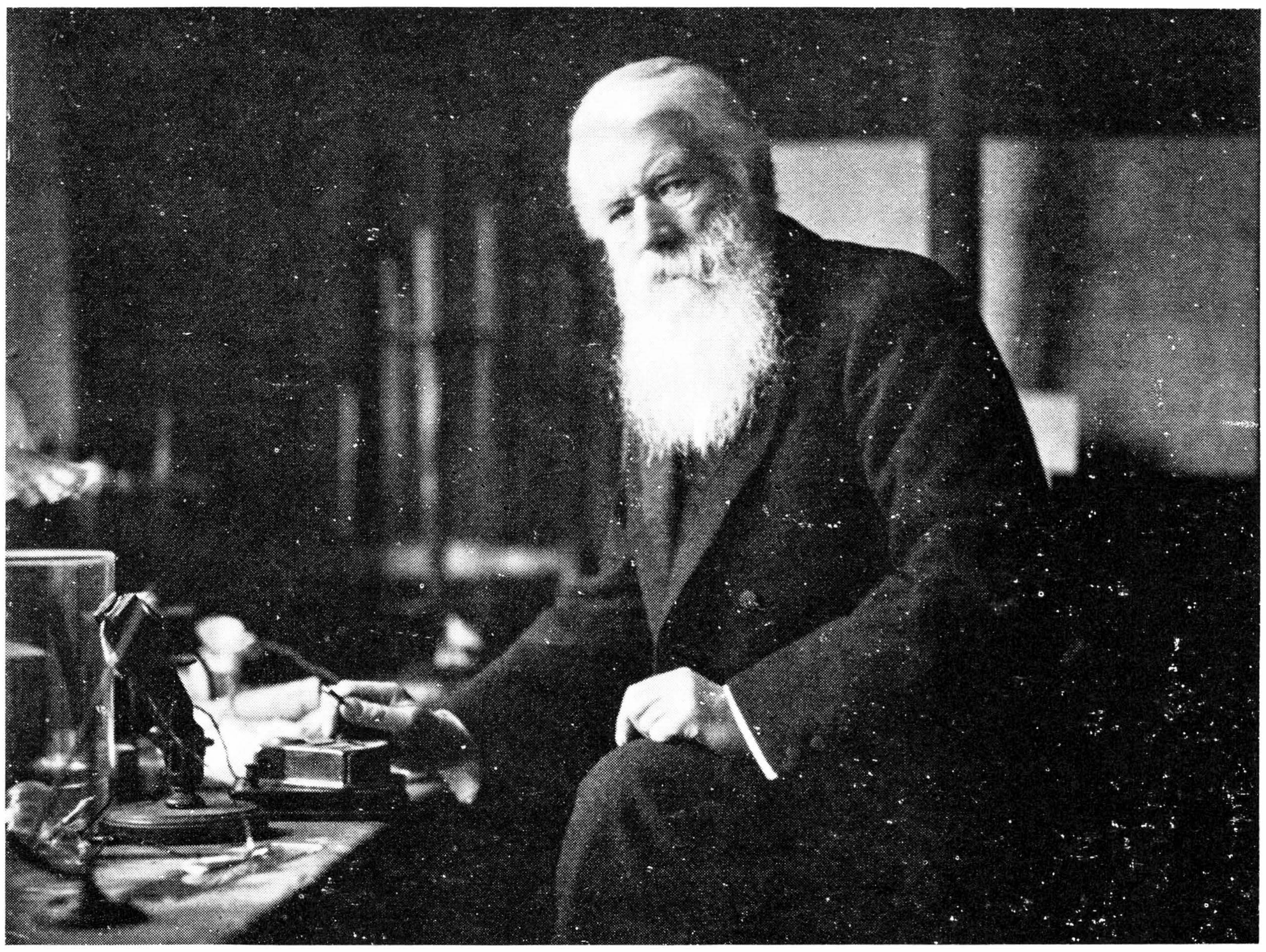
ILLUSTRÉ

PRIX : 15 CENTIMES — Nº 36 — 5 SEPTEMBRE 1886 — 285

6. « — C'est là l'inconvénient de cette philosophie du jour, de cette philosophie de rhéteurs, de grands diseurs de riens. On se contente de mots et de paroles creuses... »

8. « — Alors, puisqu'ils nous affirment qu'ils dirigent, à leur volonté, leur ballon, qu'ils viennent me prendre ici, à cette fenêtre, tous les jours de séance à l'Institut et qu'ils me ramènent! Cela m'évitera de descendre et de monter mes deux étages d'escaliers. »



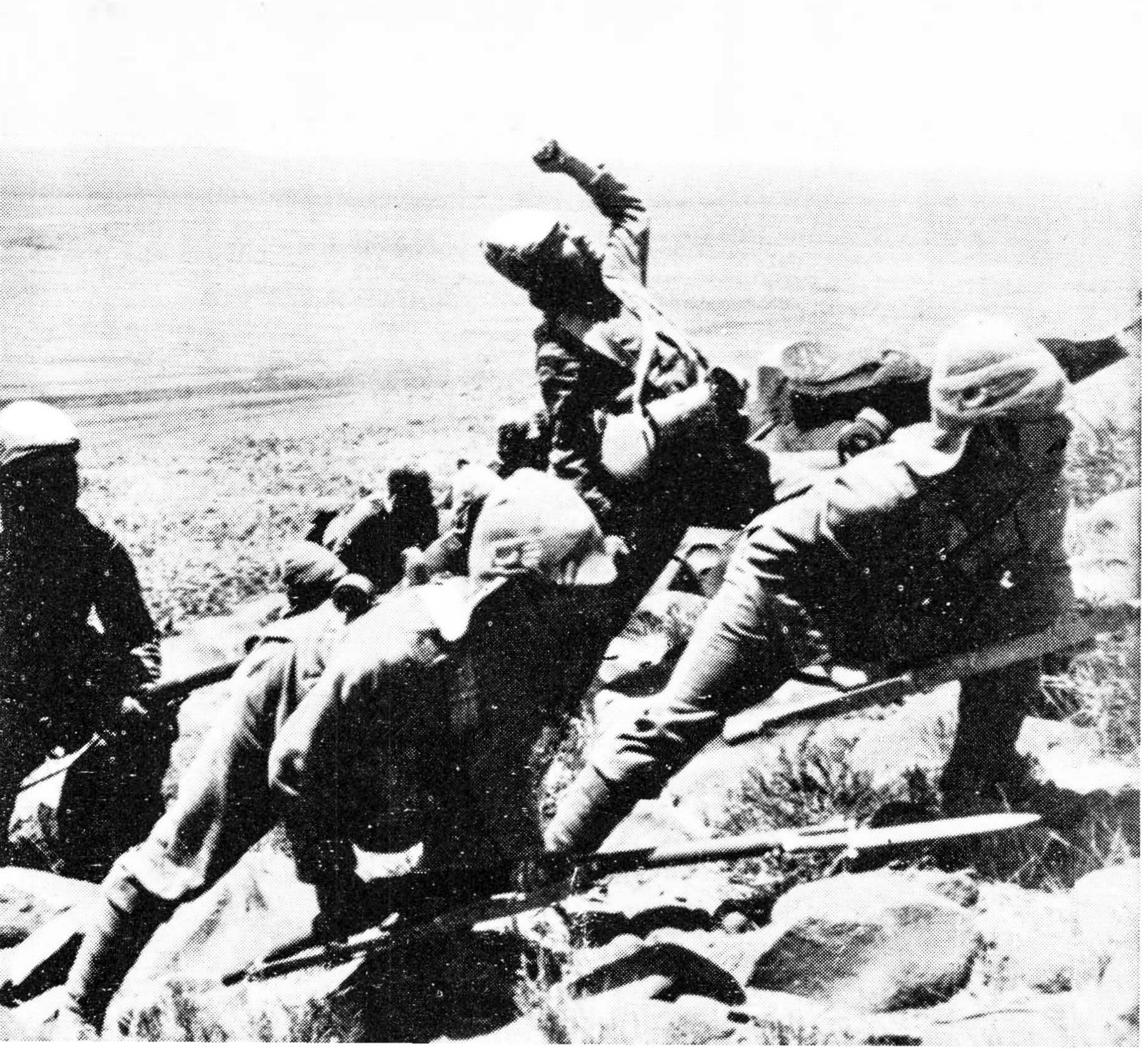


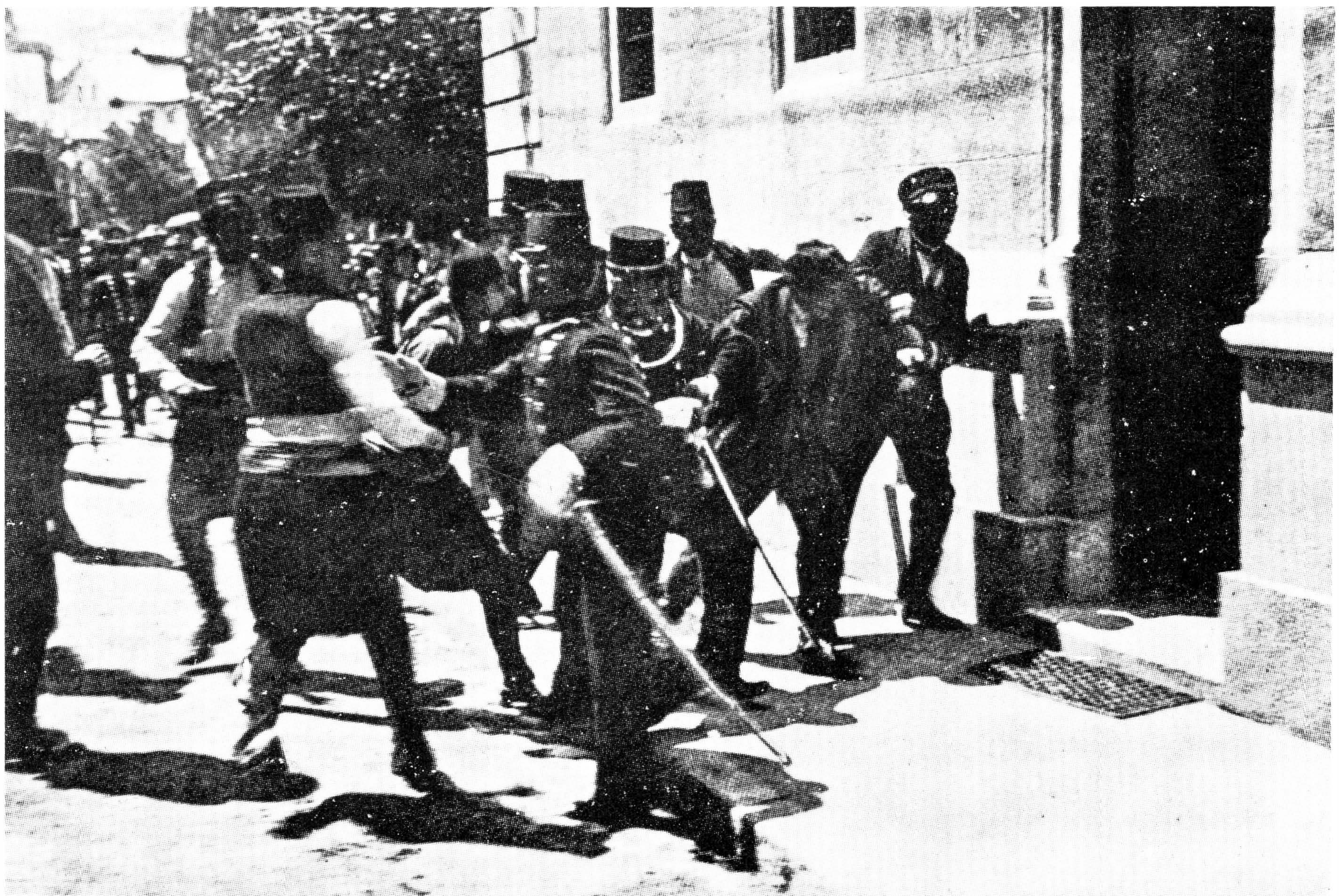
271 J. BIRTLES. W. E. Gladstone making a 'whistle-stop' speech, 1885

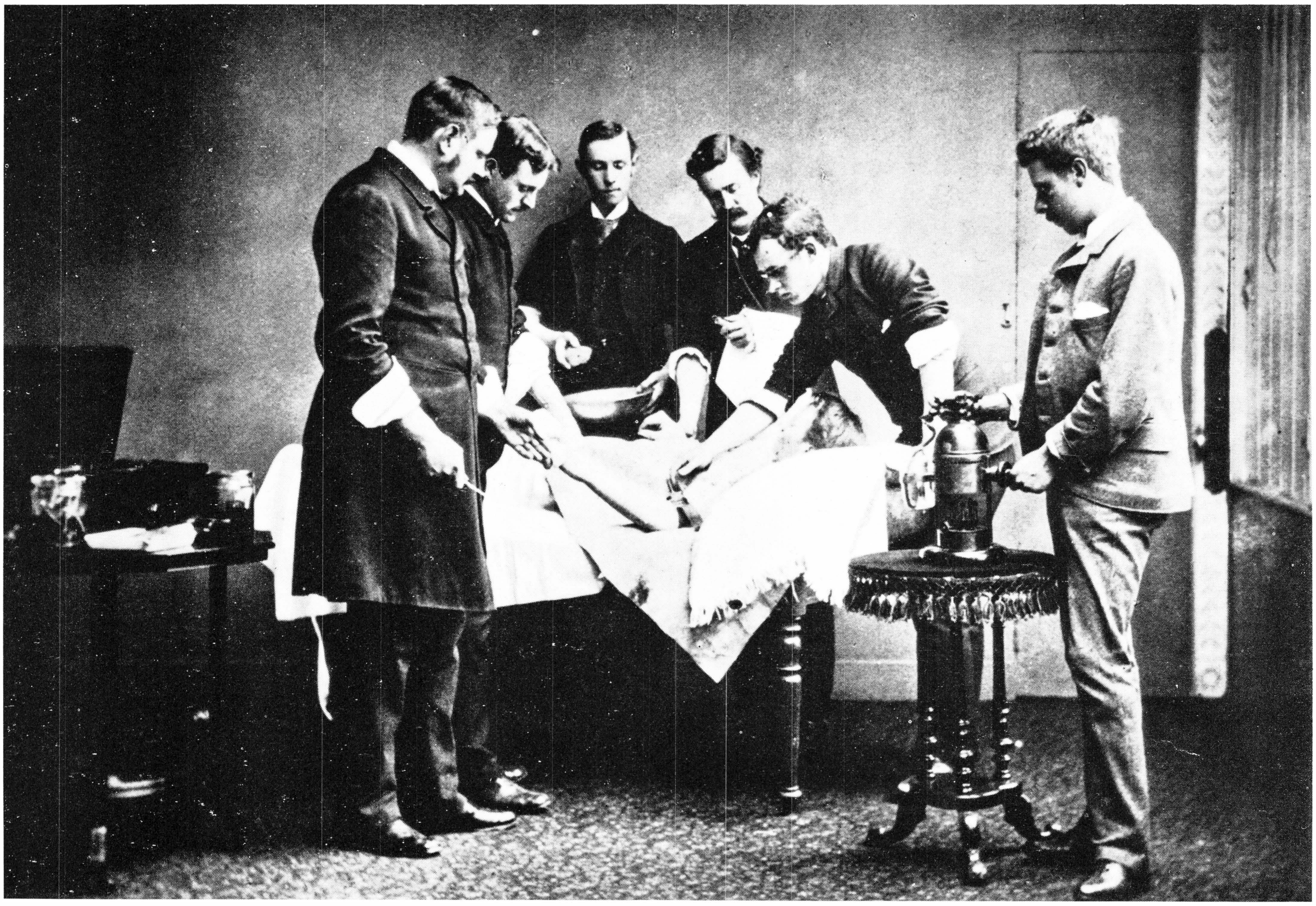
272 ELLIOTT & FRY. Sir Joseph Wilson Swan in his laboratory, 1904

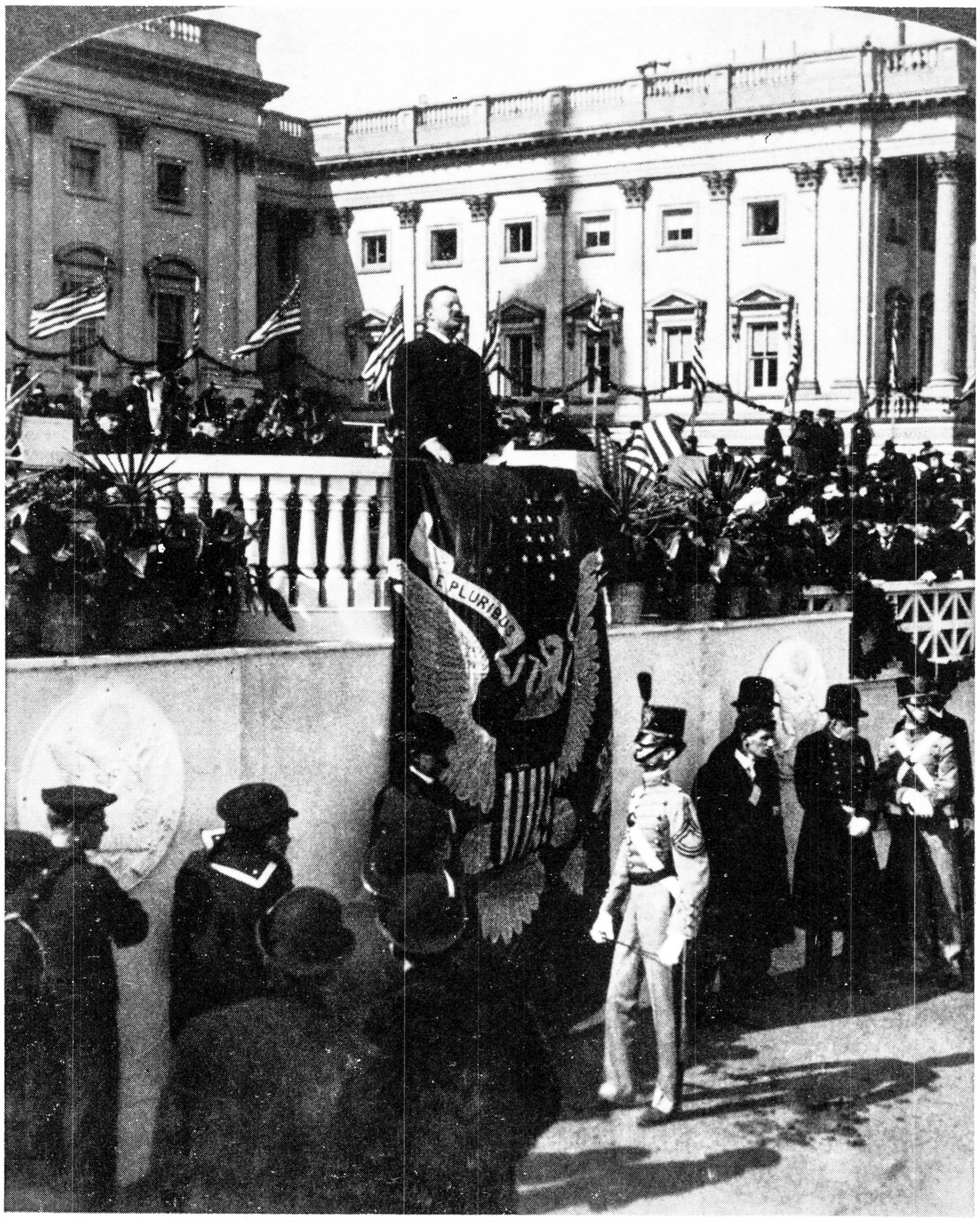
273 UNDERWOOD & UNDERWOOD. The Worcestershire Regiment charging a hill during the Boer War. Stereoscopic photograph, 1899–1900

274 PHILIPP RUBEL. Arrest of Gavrillo Princip, assassin of the Archduke Franz Ferdinand, Sarajevo, 28 June 1914









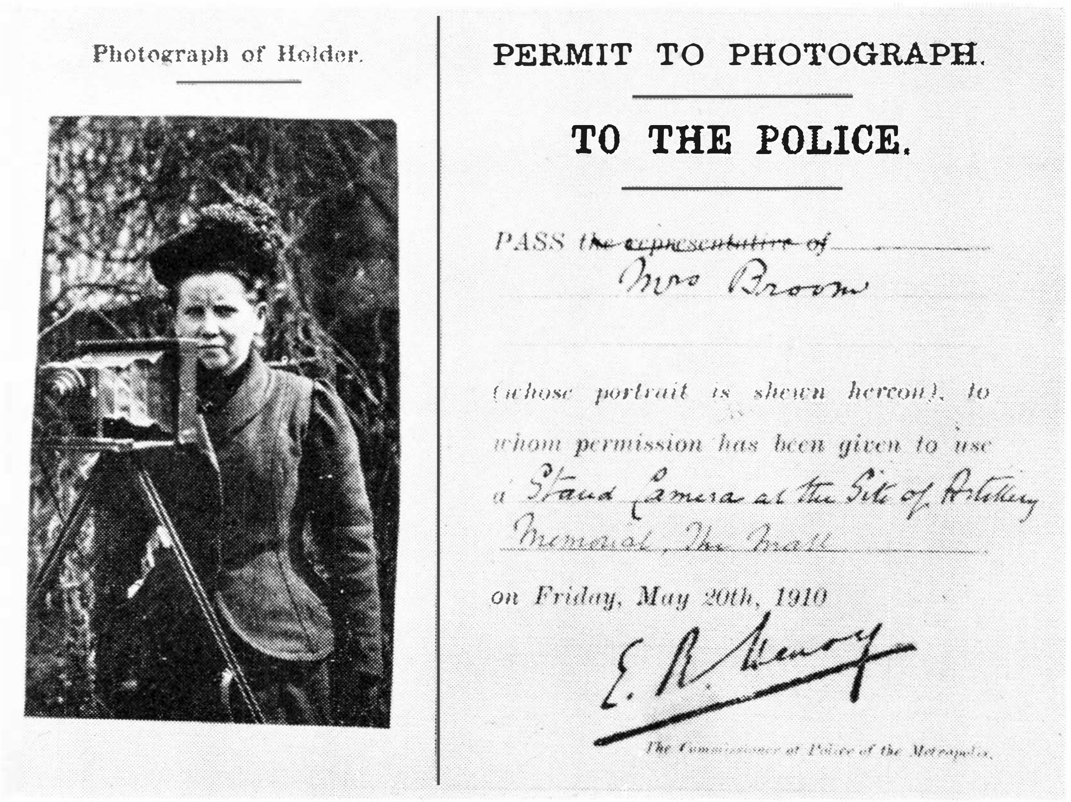
275 G. W. WILSON. Operation by Sir Alexander Ogstone, *c.* 1883

276 UNDERWOOD & UNDERWOOD. President Theodore Roosevelt's inaugural address outside the Capitol, Washington, D.C., 1905

277 MRS ALBERT BROOM's permit to photograph the funeral of Edward VII, 1910

278 P. H. EMERSON. Taking up the eel net. Platinotype, 1885

279 P. H. EMERSON. Gunner working up to wildfowl. Platinotype, 1885



Photograph of Holder.

PERMIT TO PHOTOGRAPH.

TO THE POLICE.

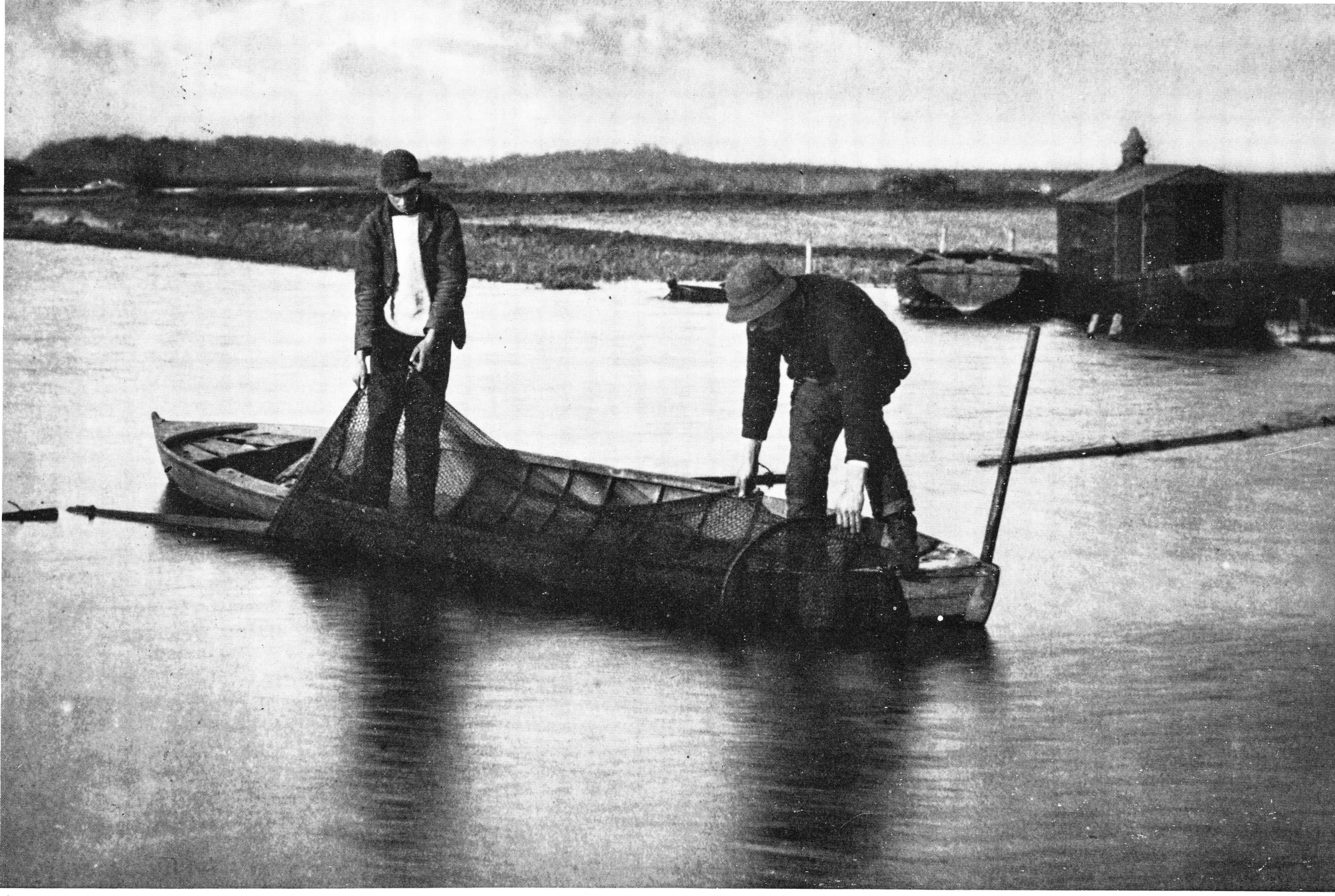
PASS ~~the representative of~~
Mrs Broom

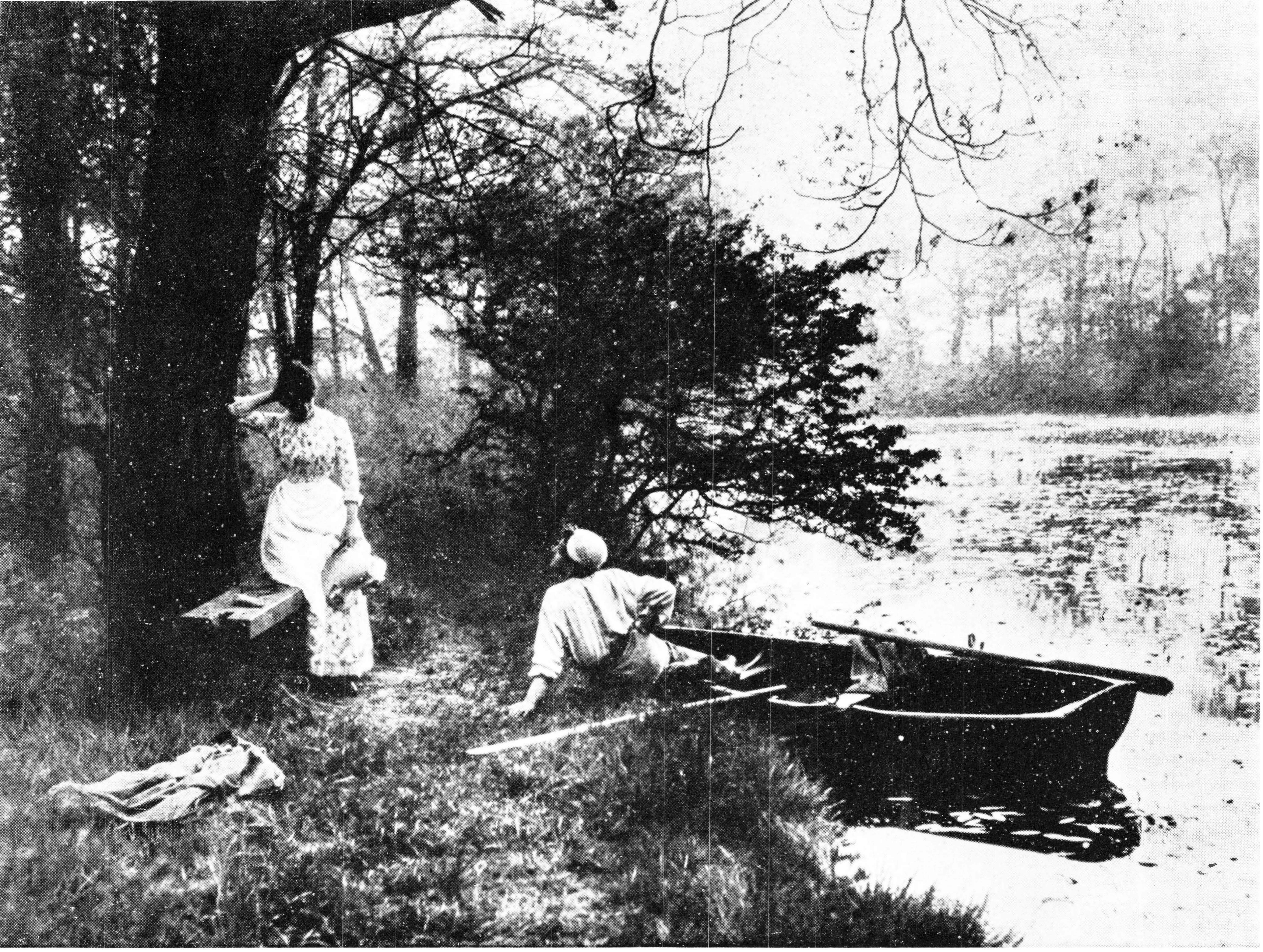
(whose portrait is shewn hereon), to whom permission has been given to use a Stand Camera at the Site of Artillery Memorial, The Mall

on Friday, May 20th, 1910

E. R. Henry

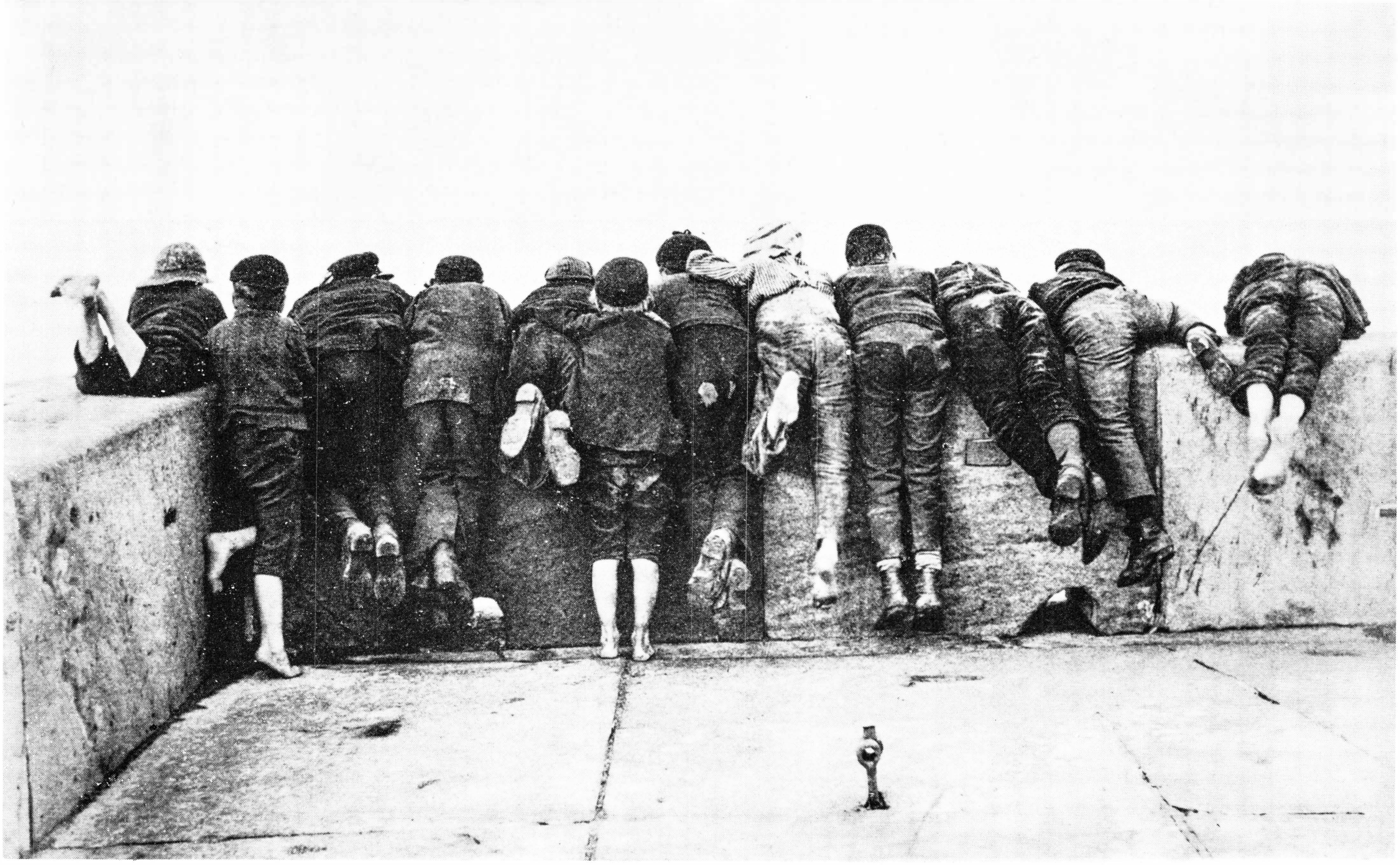
The Commissioner of Police of the Metropolis.

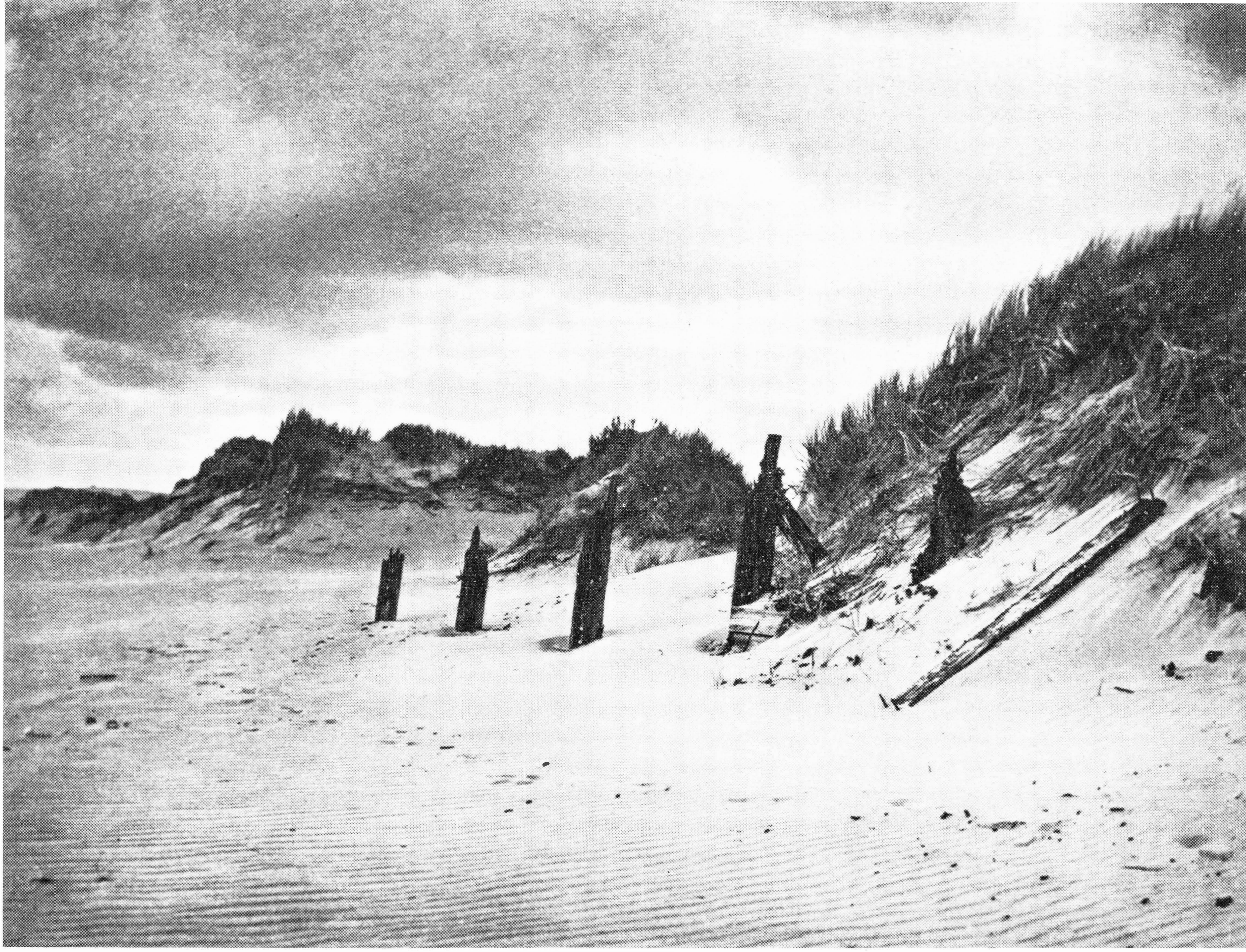




280 LYDDELL SAWYER. 'In the twilight'. Photogravure, 1888

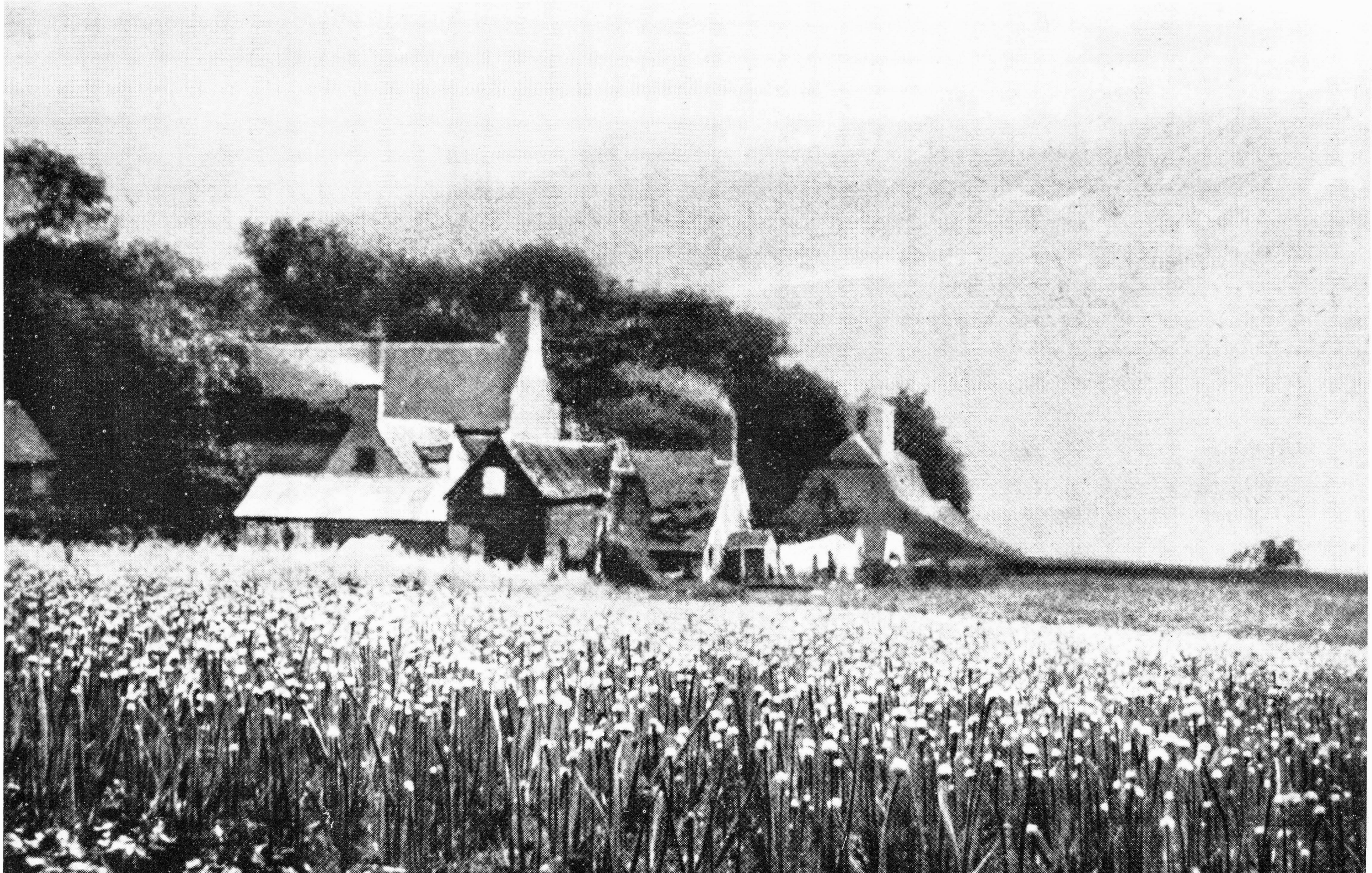
281 FRANK M. SUTCLIFFE. 'Excitement'. Platinotype, 1888

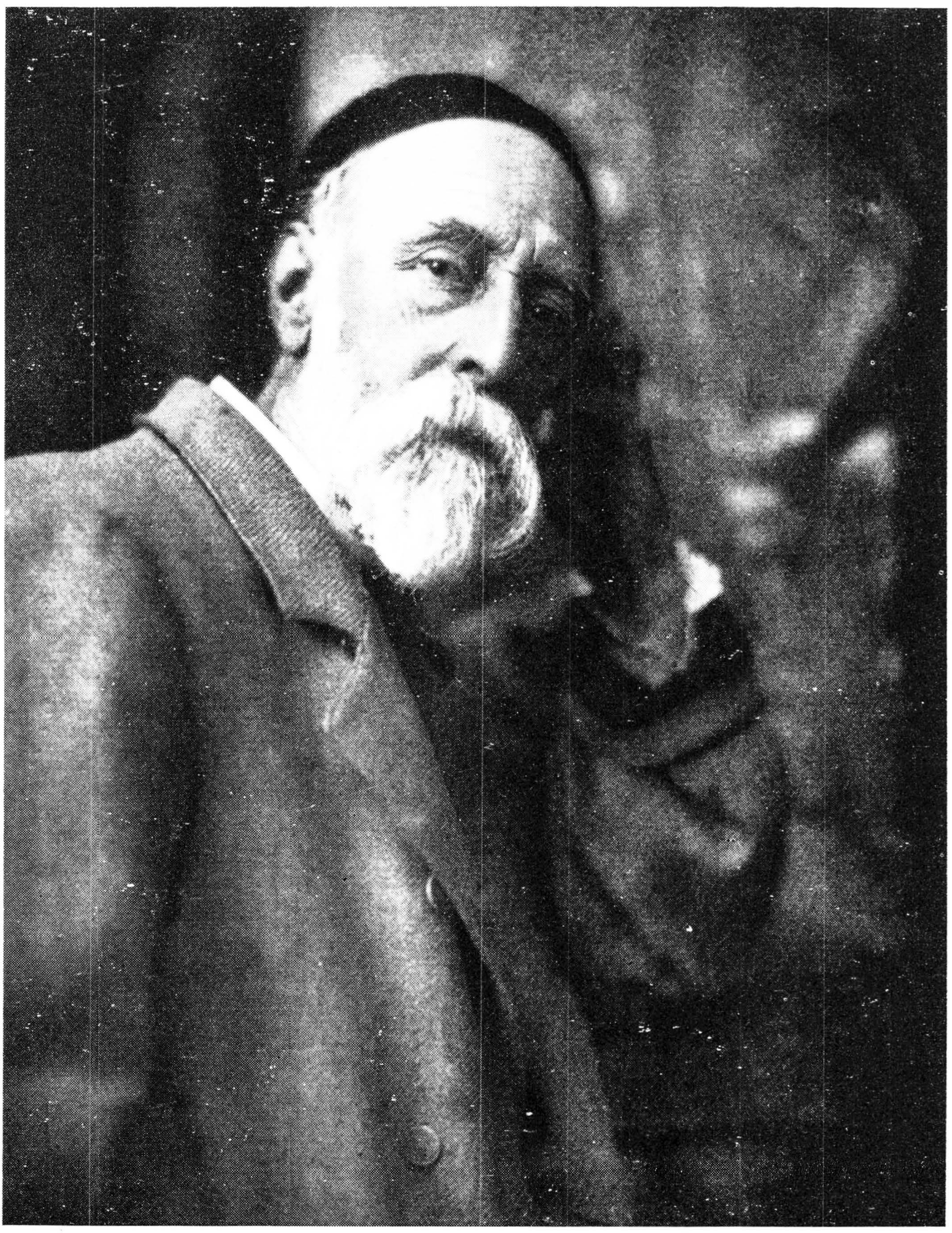


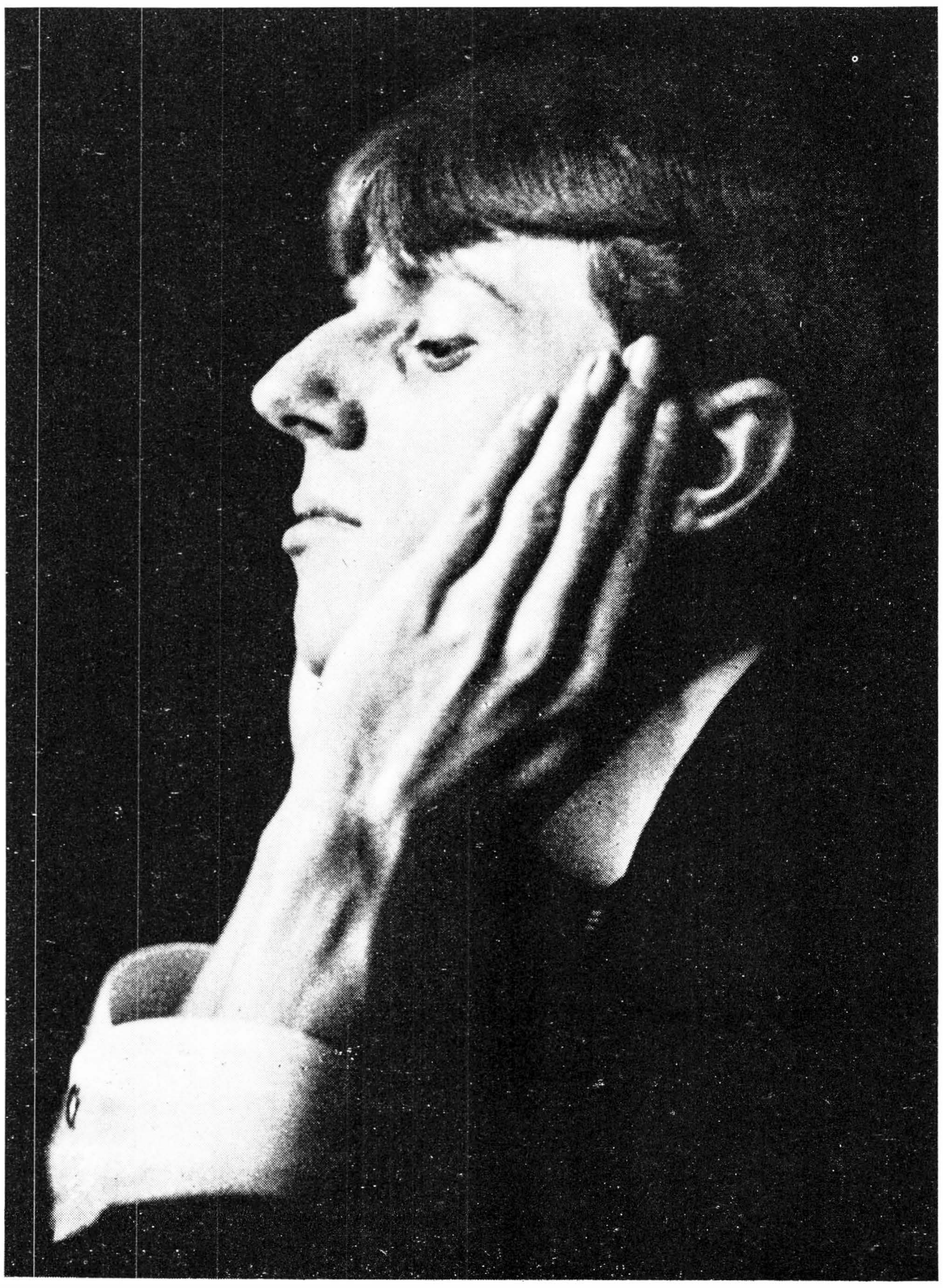


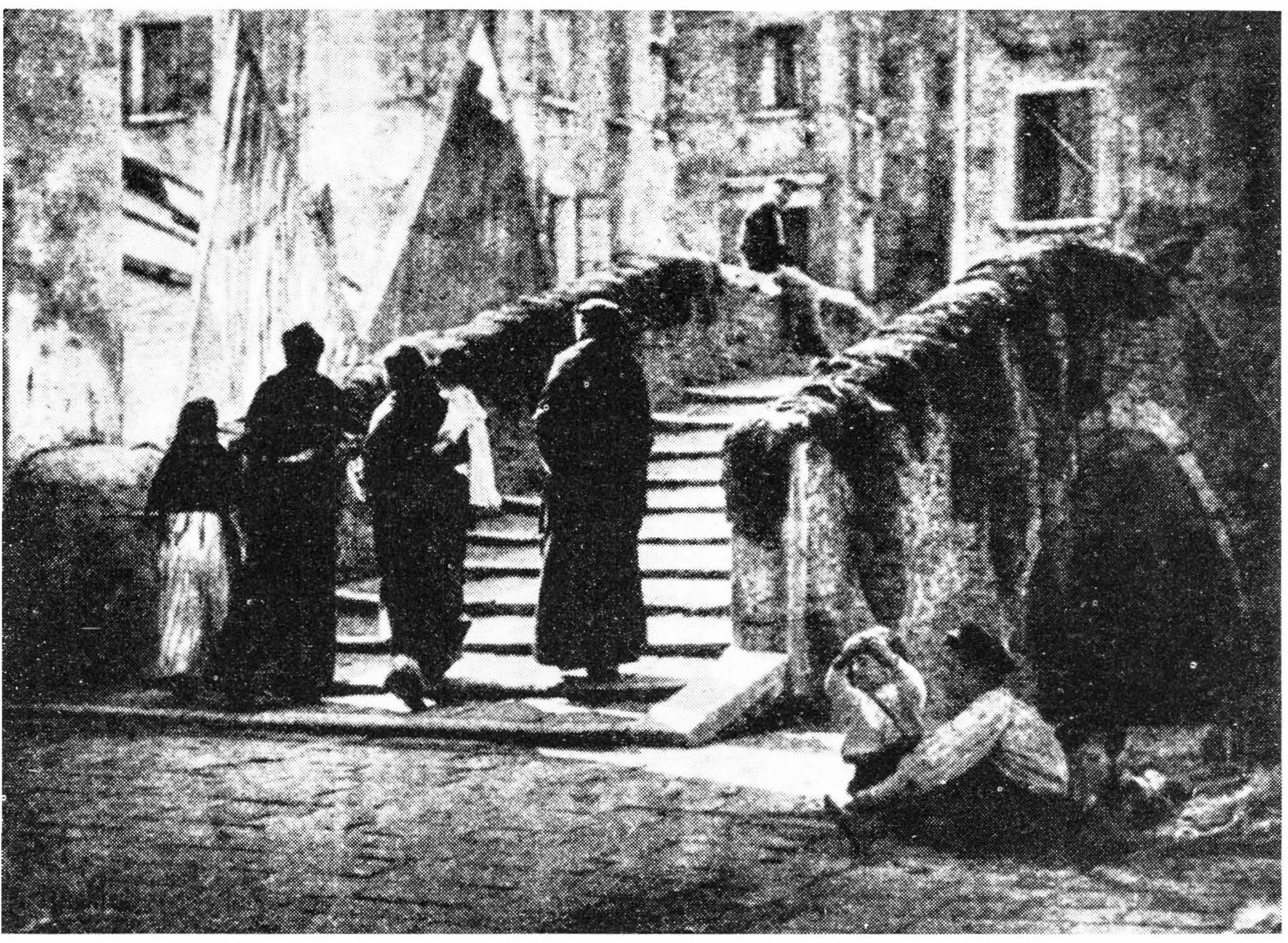
282 B. GAY WILKINSON. Sand dunes. Photogravure, 1890

283 GEORGE DAVISON. 'The Onion Field', 1890. Reproduction









284 J. CRAIG ANNAN. The painter and etcher Sir William Strang. Photogravure, *c.* 1900

285 H. H. H. CAMERON. G. W. Watts. Photogravure, *c.* 1892

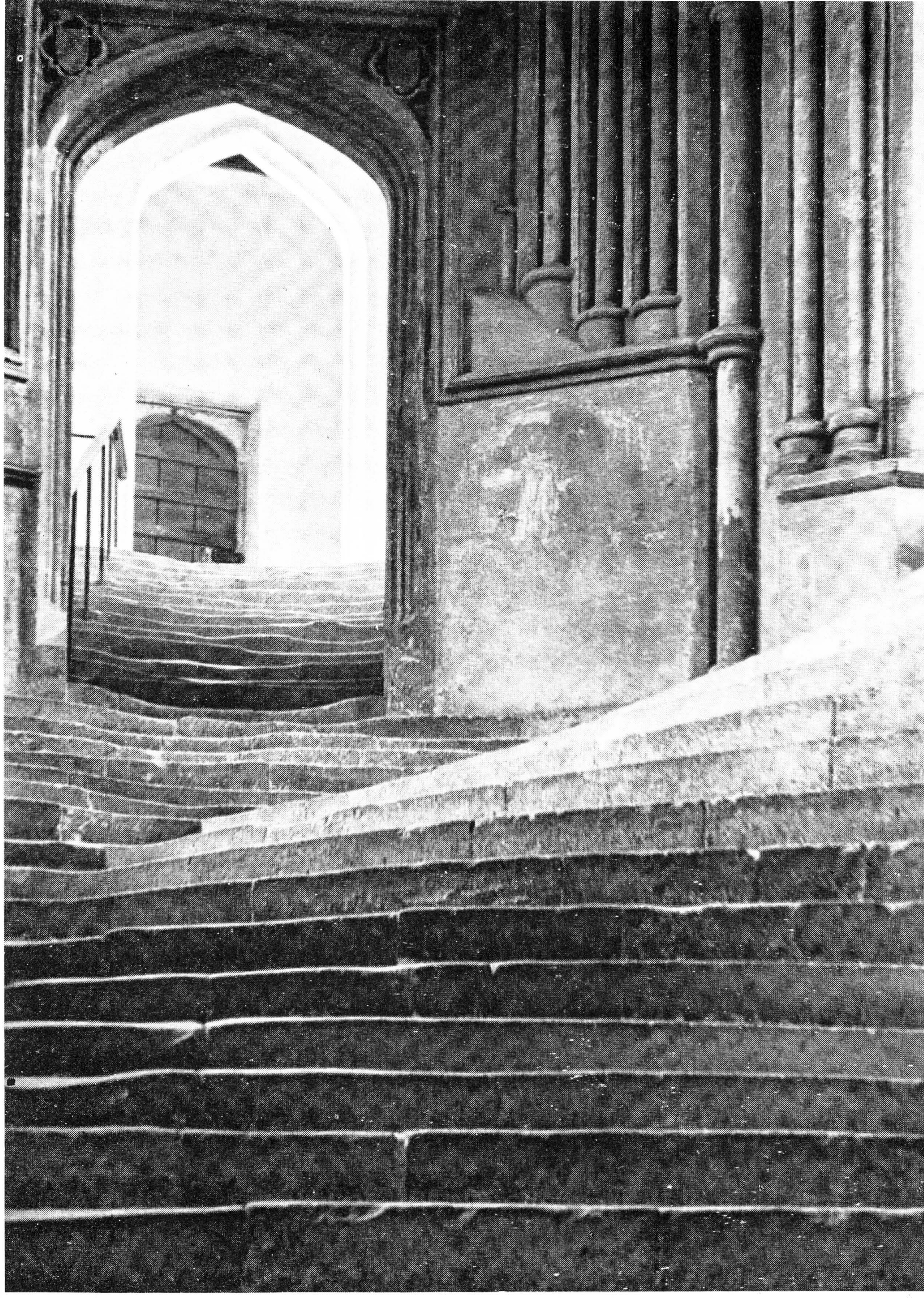
286 FREDERICK H. EVANS. Aubrey Beardsley. Platinotype, 1895

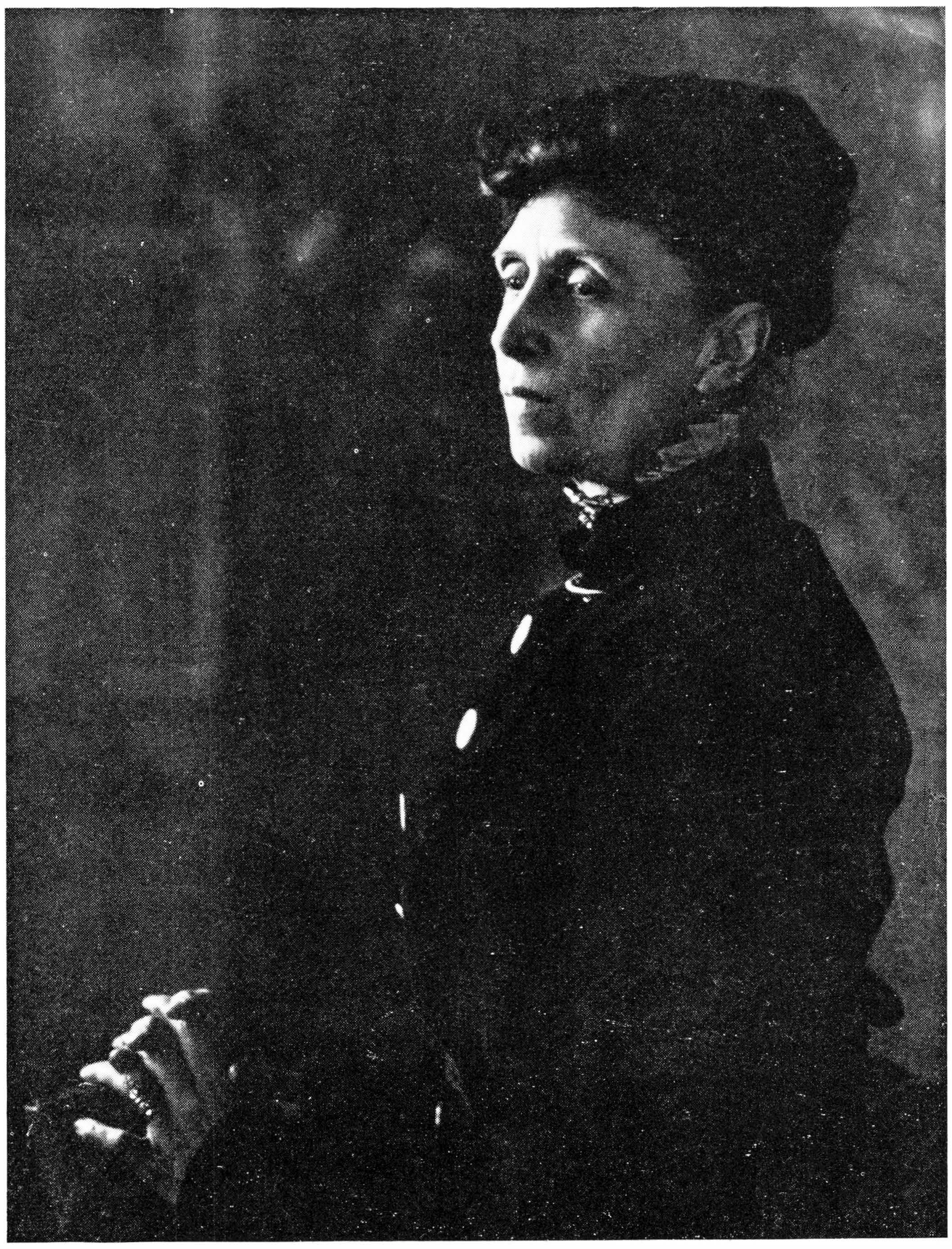
287 ALEXANDER KEIGHLEY. 'The Bridge'. Bromoil print, 1906. Reproduction

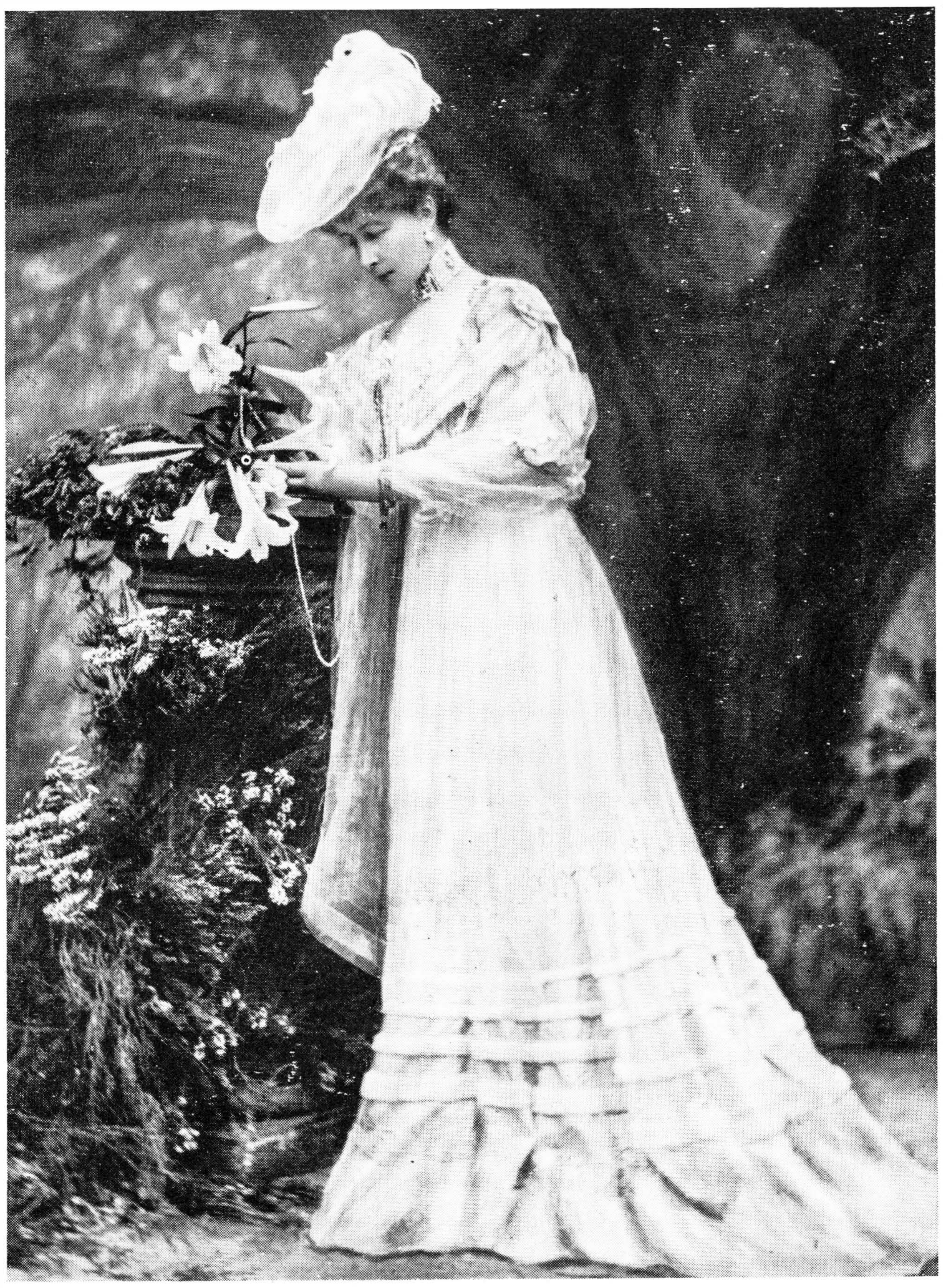
288 FREDERICK H. EVANS. 'Sea of Steps' (Wells Cathedral). Platinotype, 1903

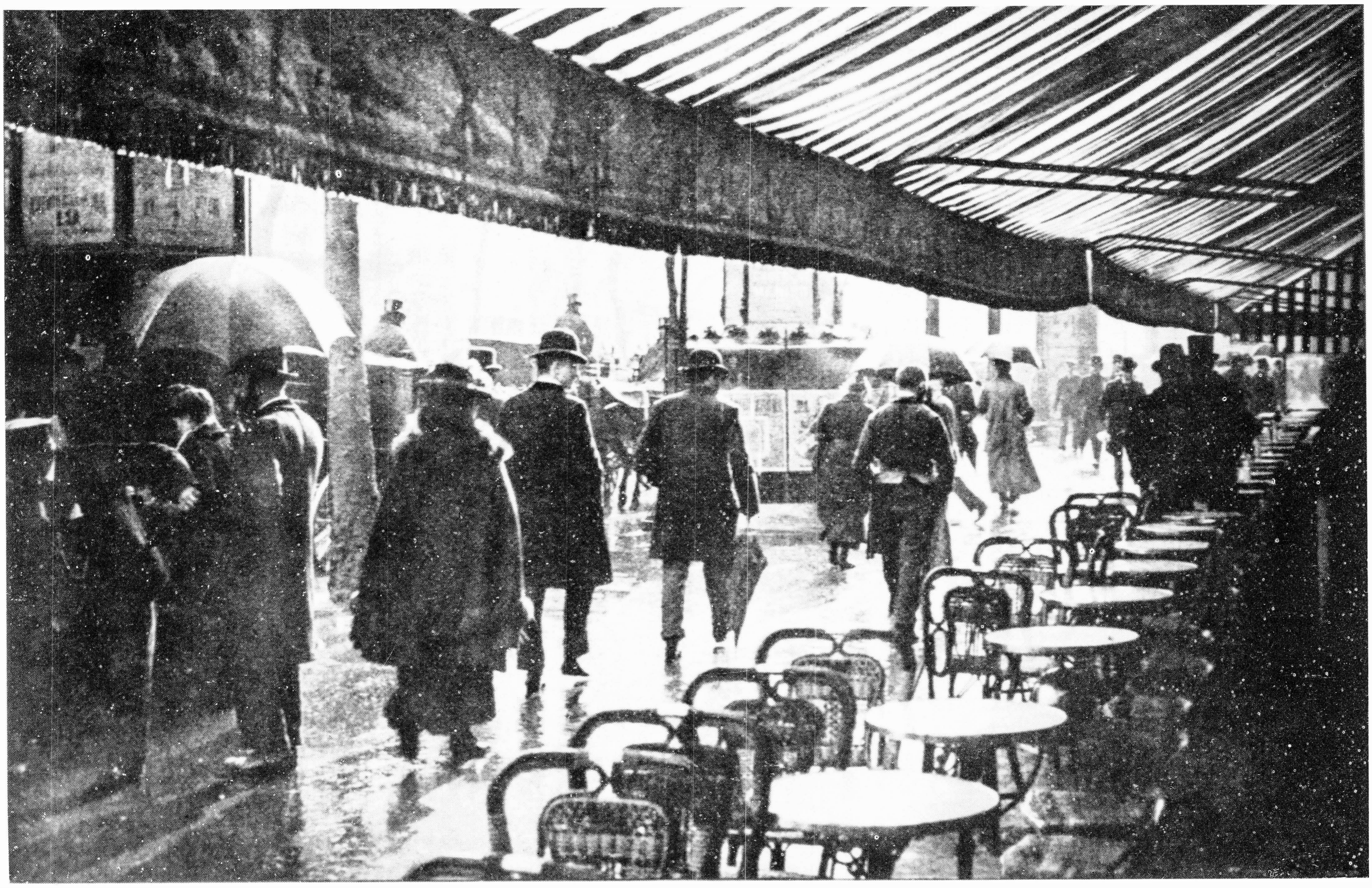
289 E. O. HOPPE. Alice Meynell, 1908

290 ALICE HUGHES. The Archduchess Stephanie. Platinotype, 1905





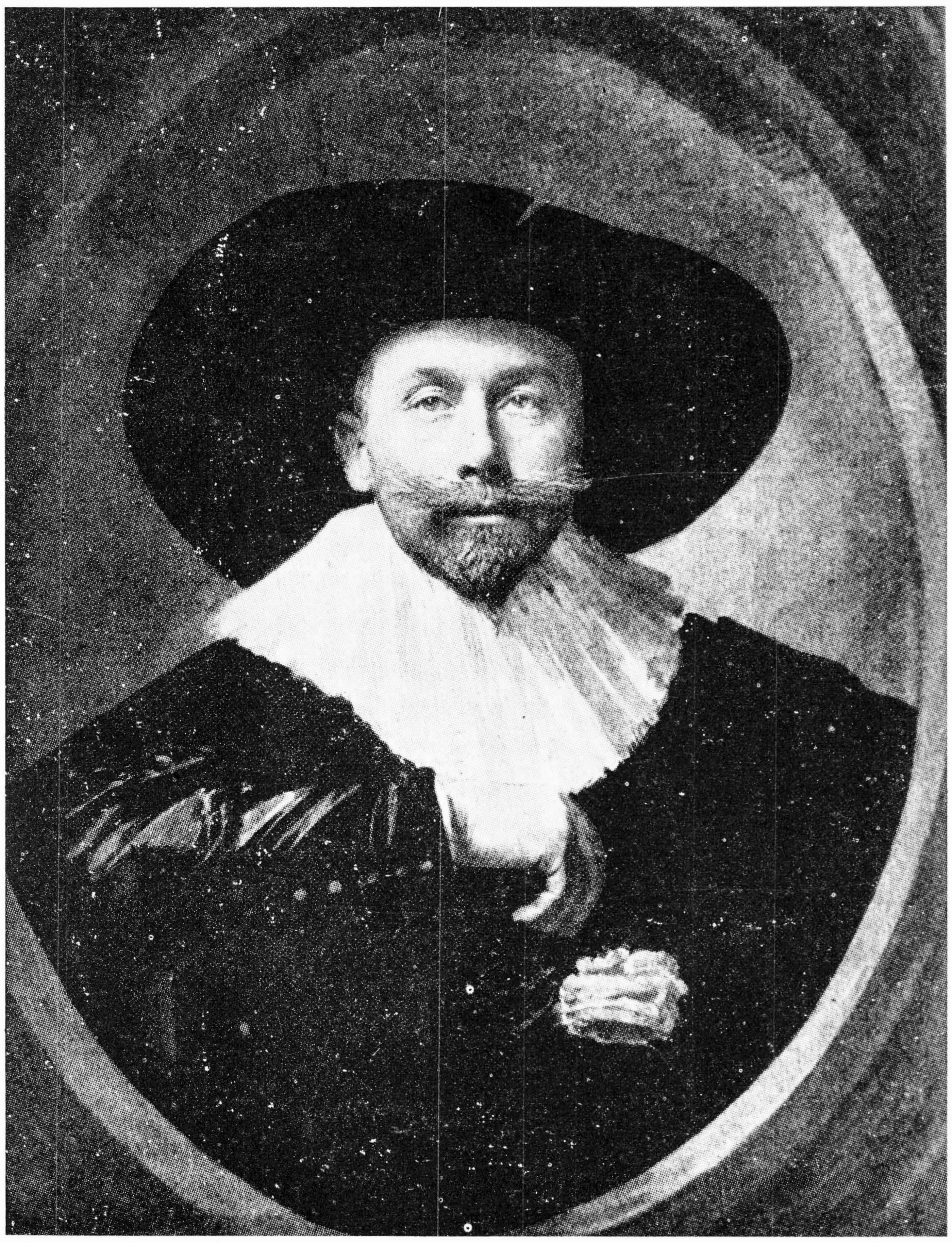


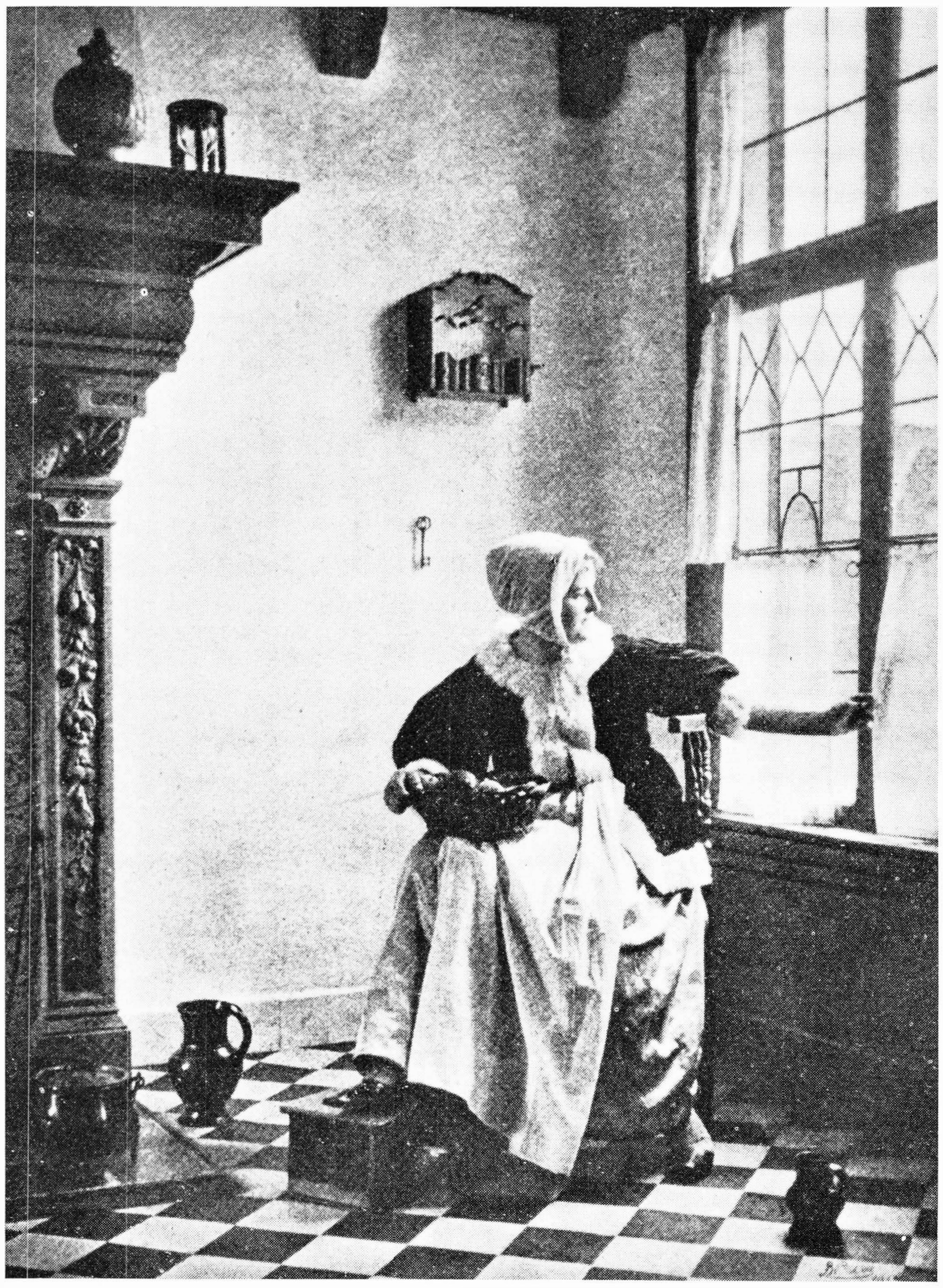


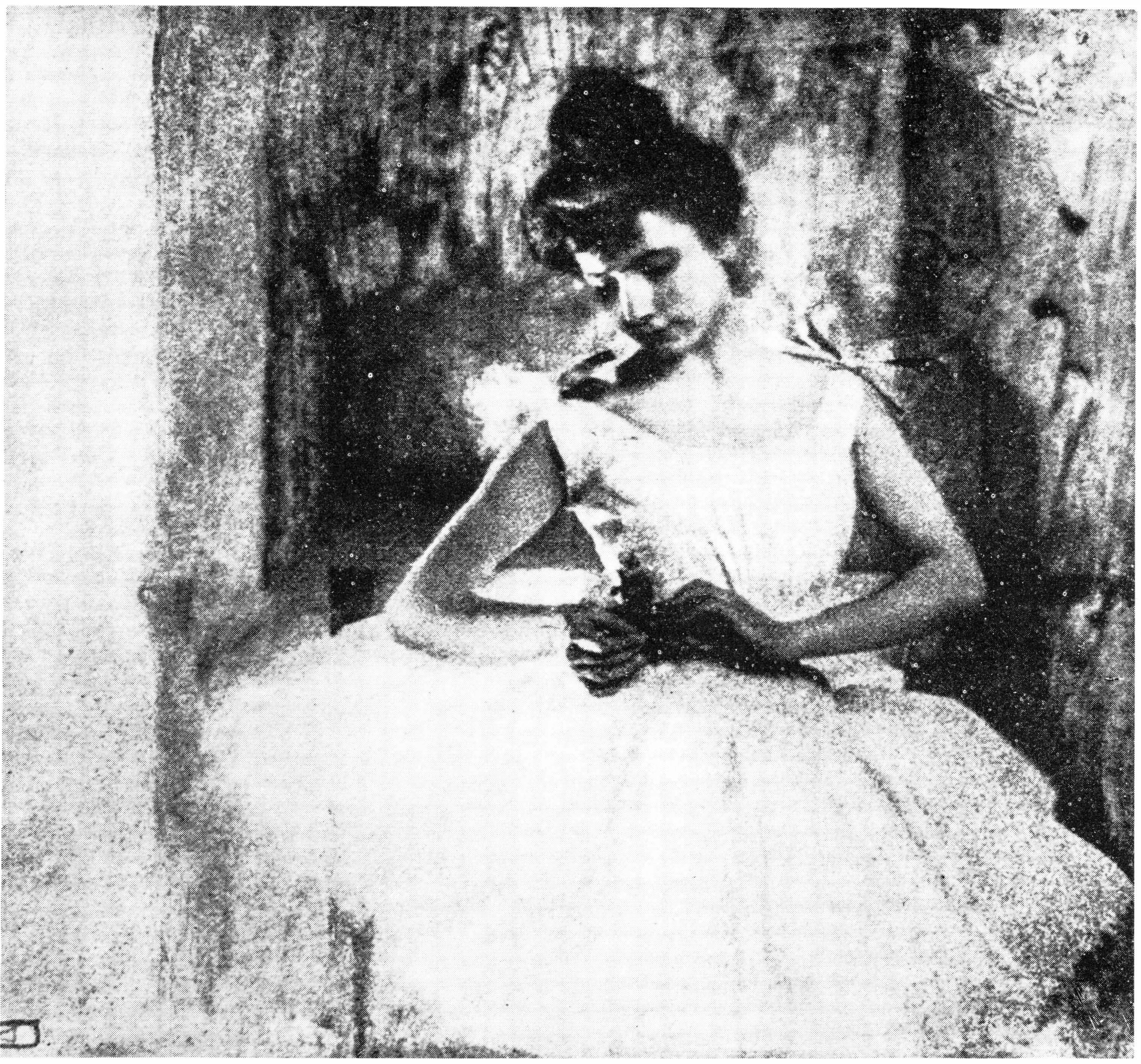
291 M. BUCQUET. 'Effet de Pluie', *c.* 1899. Reproduction

292 J. C. STRAUSS. Photograph in the style of Frans Hals, 1904. Reproduction

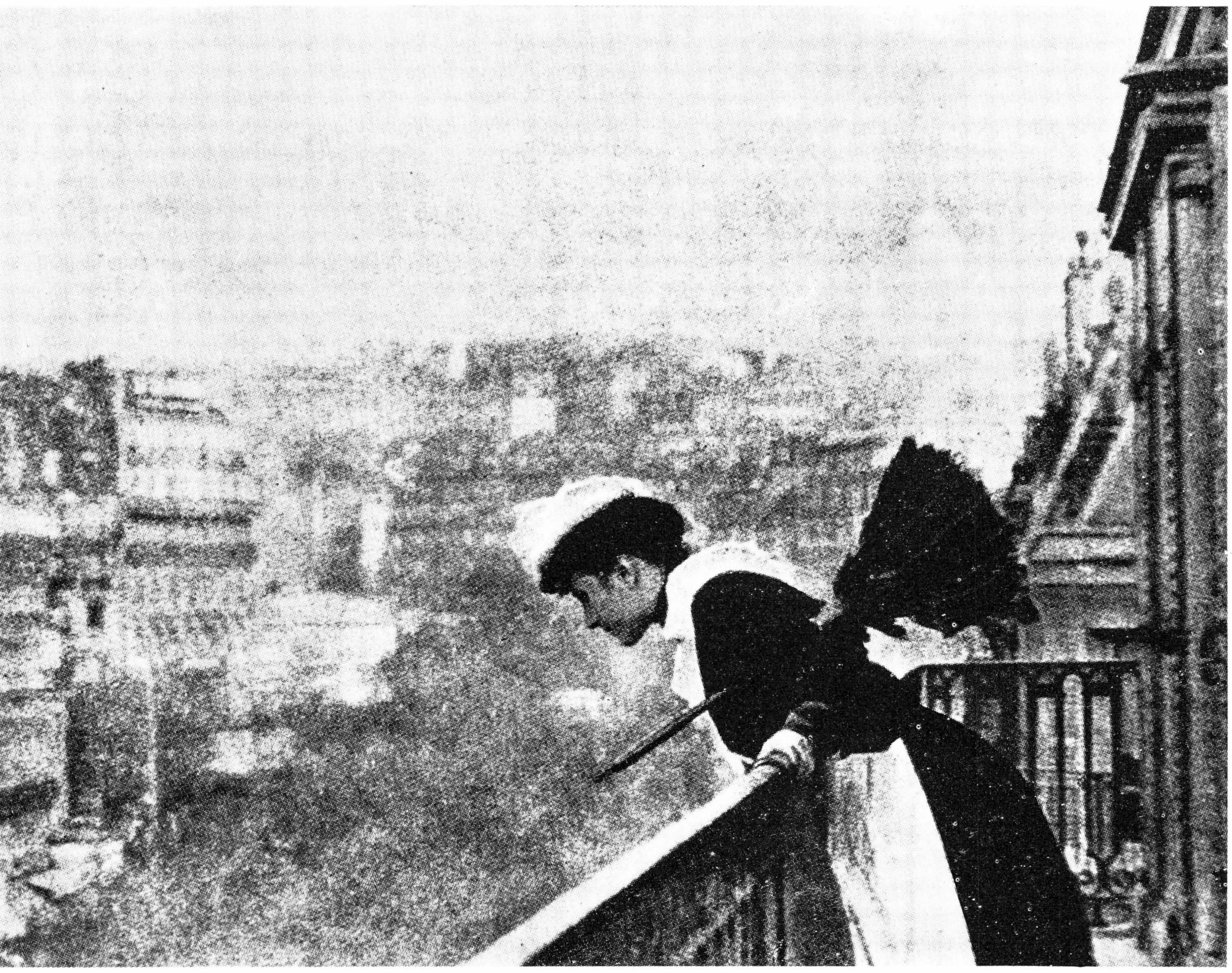
293 RICHARD POLAK. Photograph in the style of Pieter de Hoogh, 1914. Reproduction

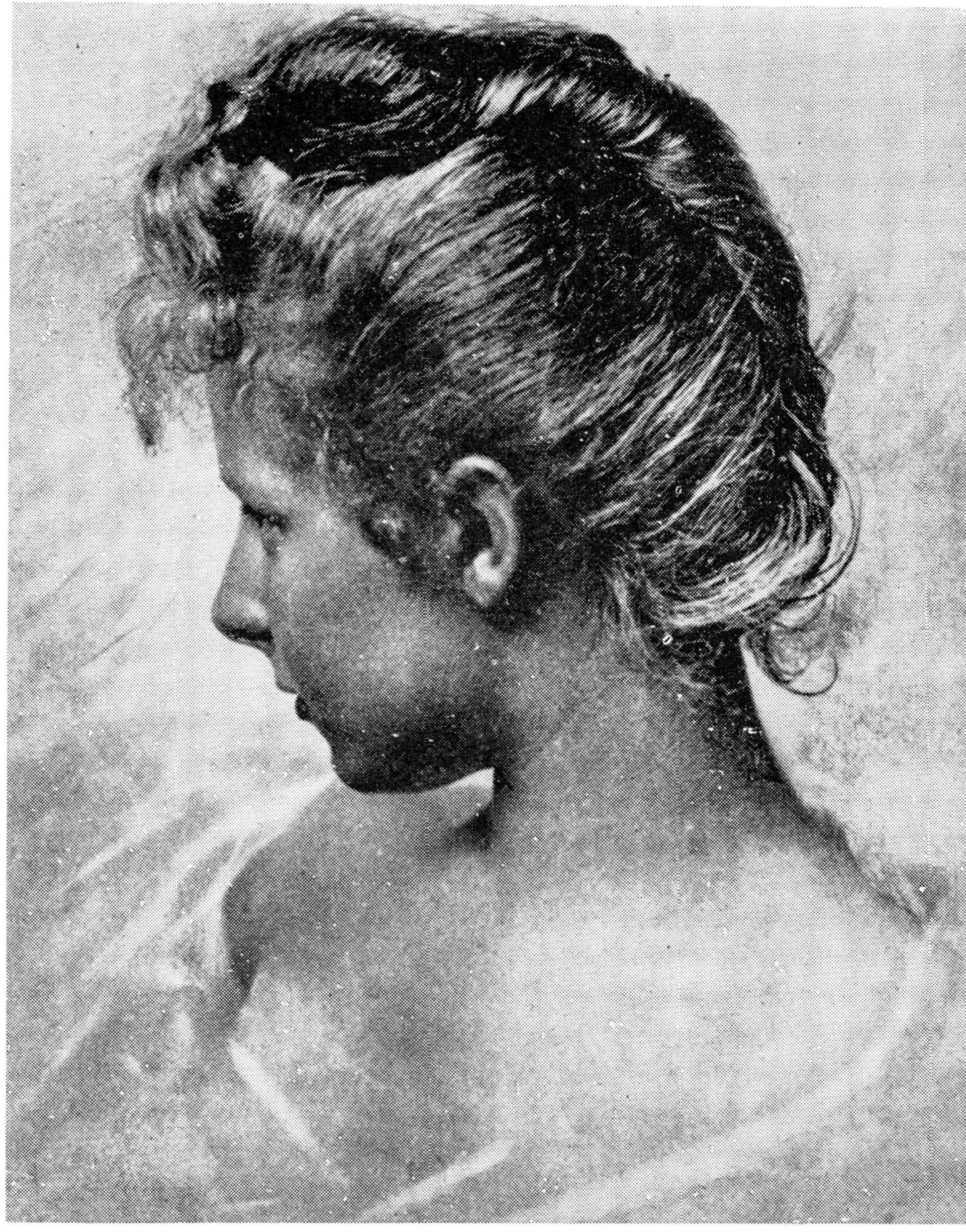


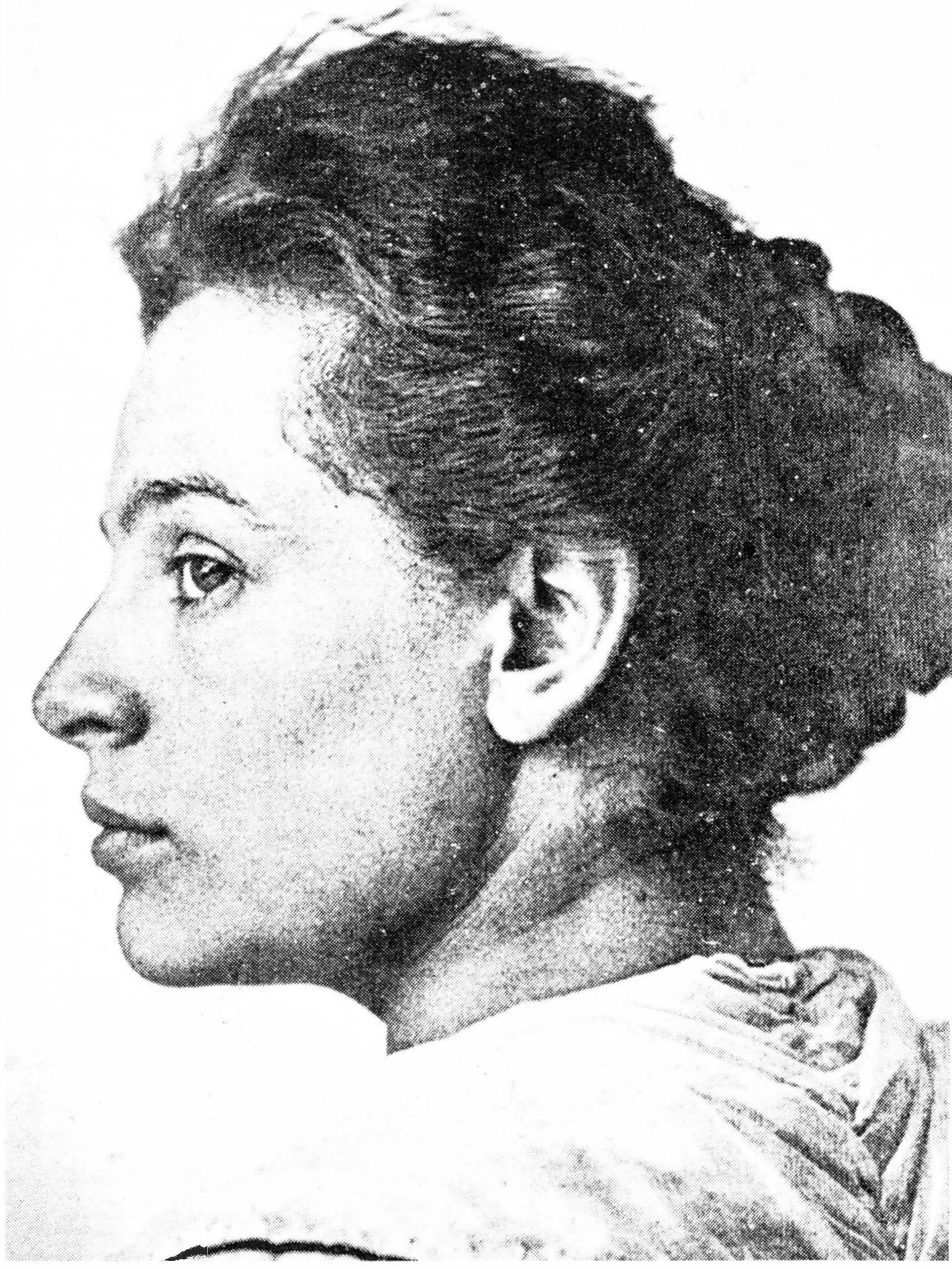


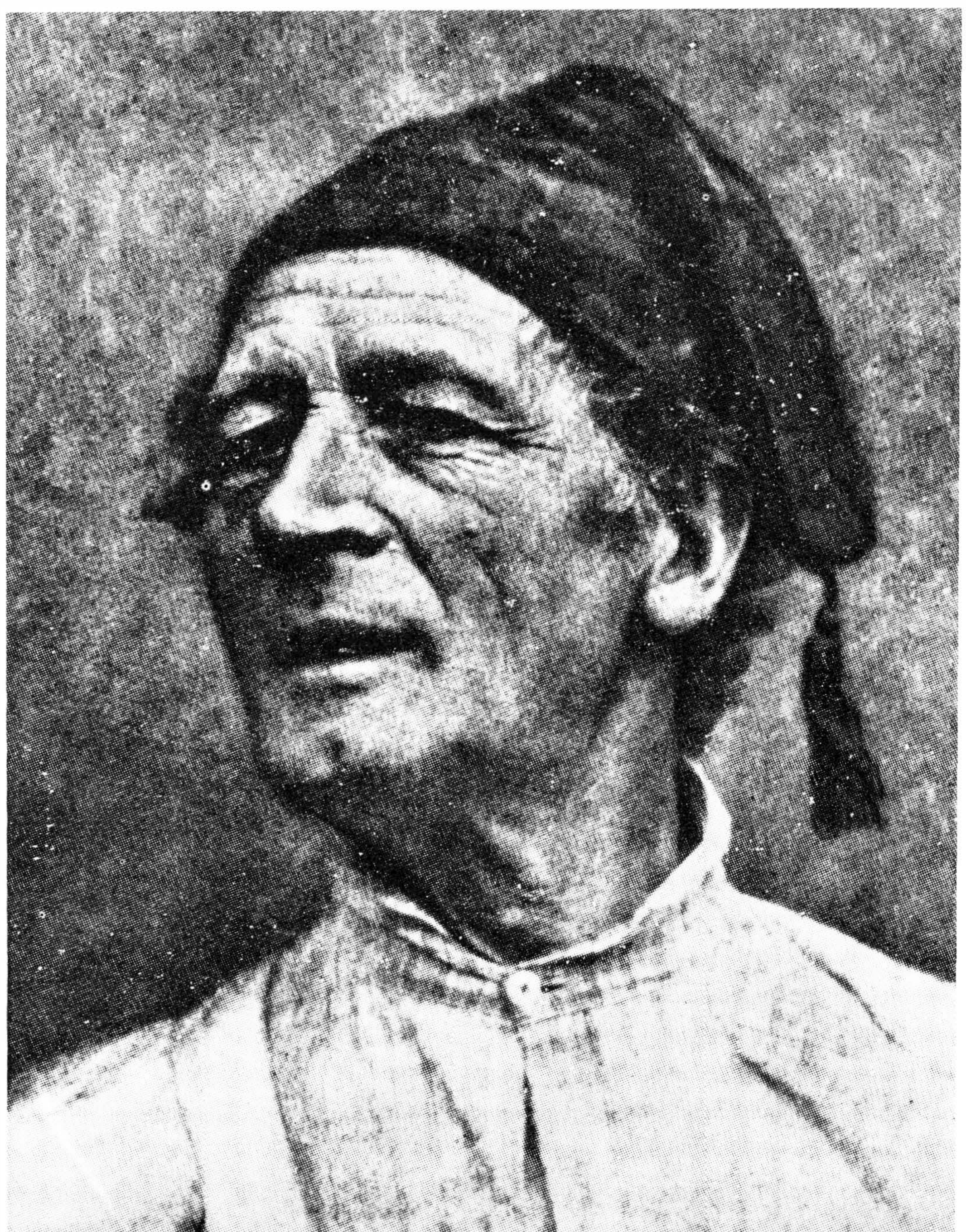


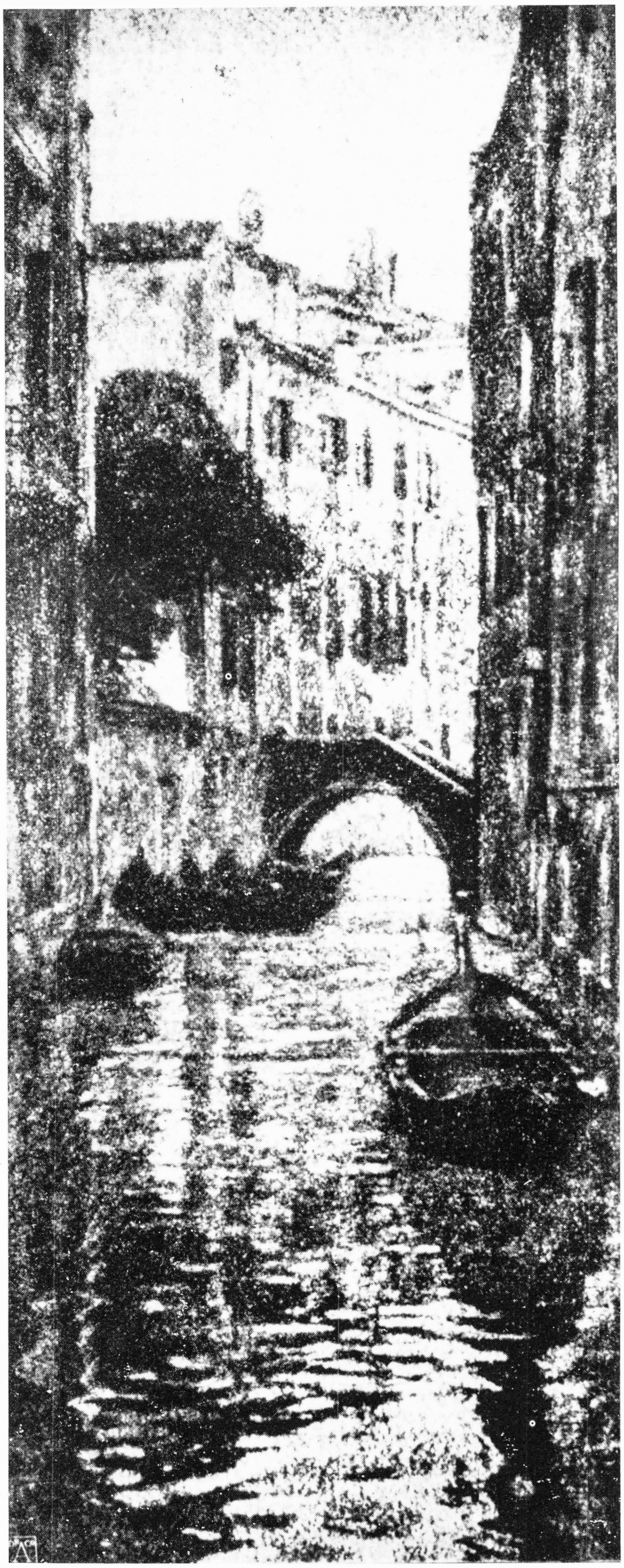
294 ROBERT DEMACHY. Ballet dancer. Gum print, 1904. Reproduction
295 E. J. C. PUYO. 'Montmartre'. Gum print, *c.* 1900. Reproduction
296 ROBERT DEMACHY. 'Primavera'. Gum print, *c.* 1896
297 HUGO ERFURTH. A young woman. Gum print, 1898
298 HANS WATZEK. A peasant. Gum print, 1894.











299 HEINRICH KÜHN. Venice. Gum print, 1897. Reproduction

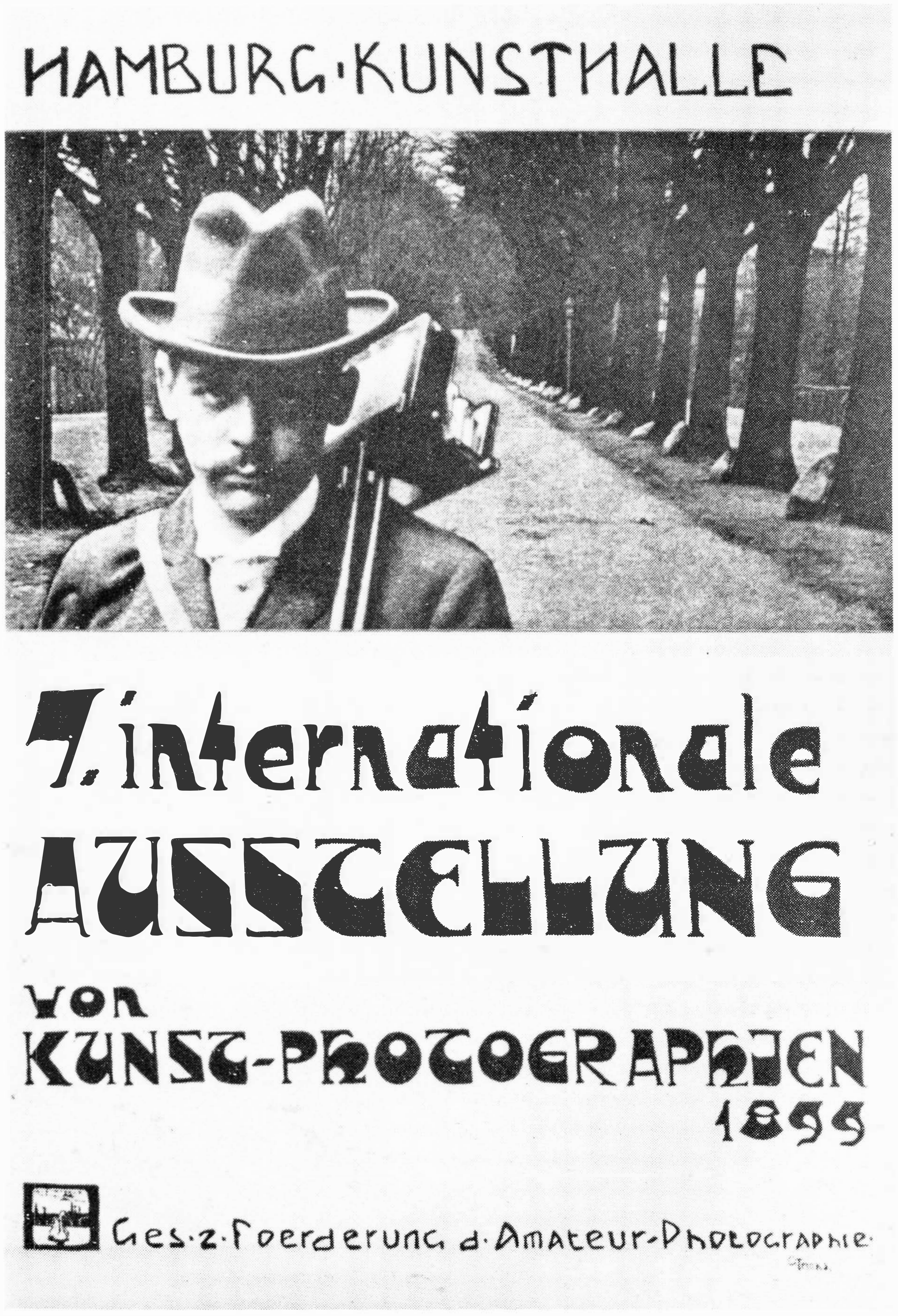
300 CLARENCE H. WHITE. 'Lady in Black'. Photogravure, *c.* 1907

301 Title-page of exhibition catalogue, Hamburg Kunsthalle, 1899

302 MAURICE GUIBERT. Toulouse-Lautrec at Malromé, *c.* 1896

303 E. NOTHMANN. 'In the Garden'. Gum print, 1897. Reproduction

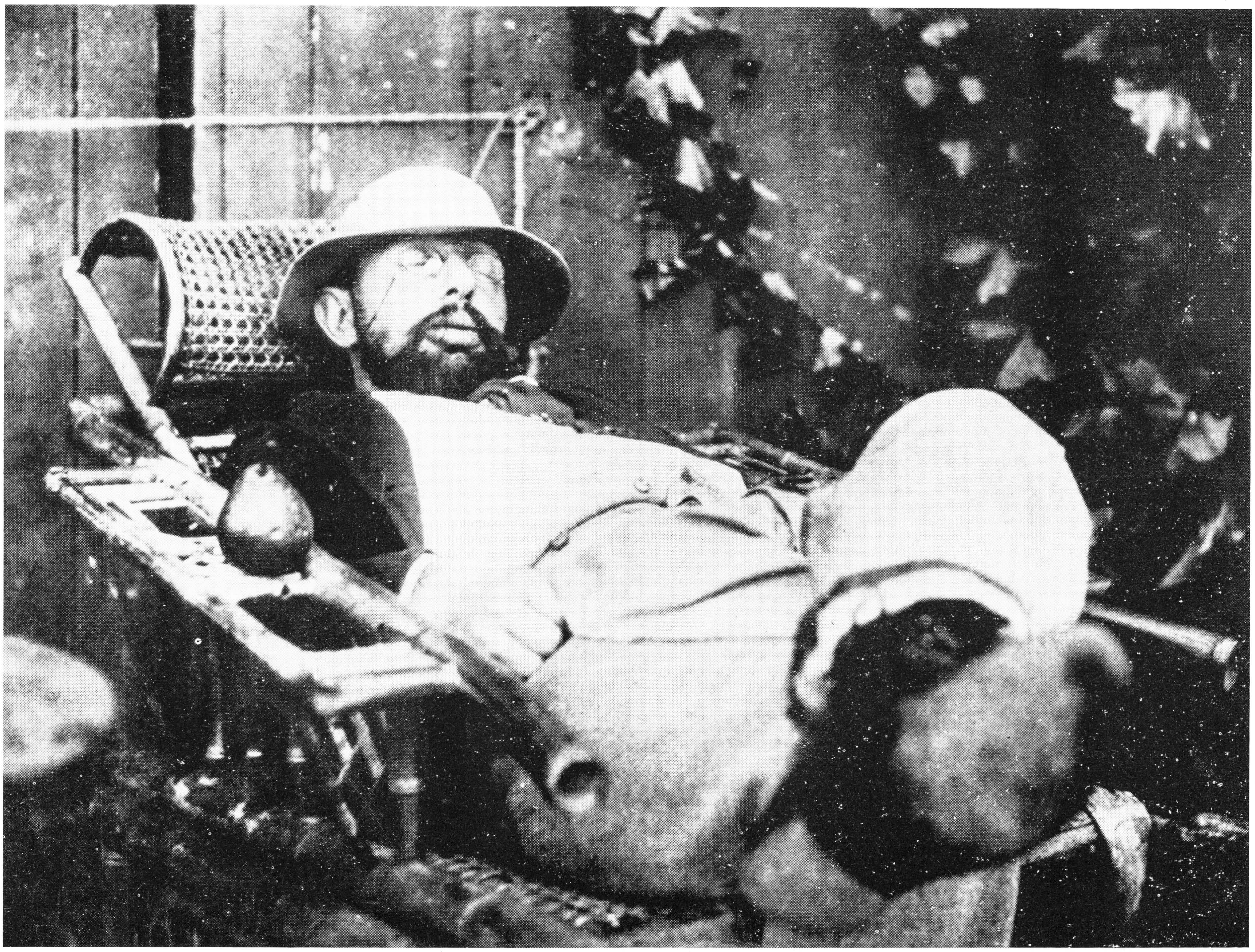
304 EDWARD STEICHEN. Auguste Rodin with his sculpture of Victor Hugo and 'The Thinker'. Gum print, 1902

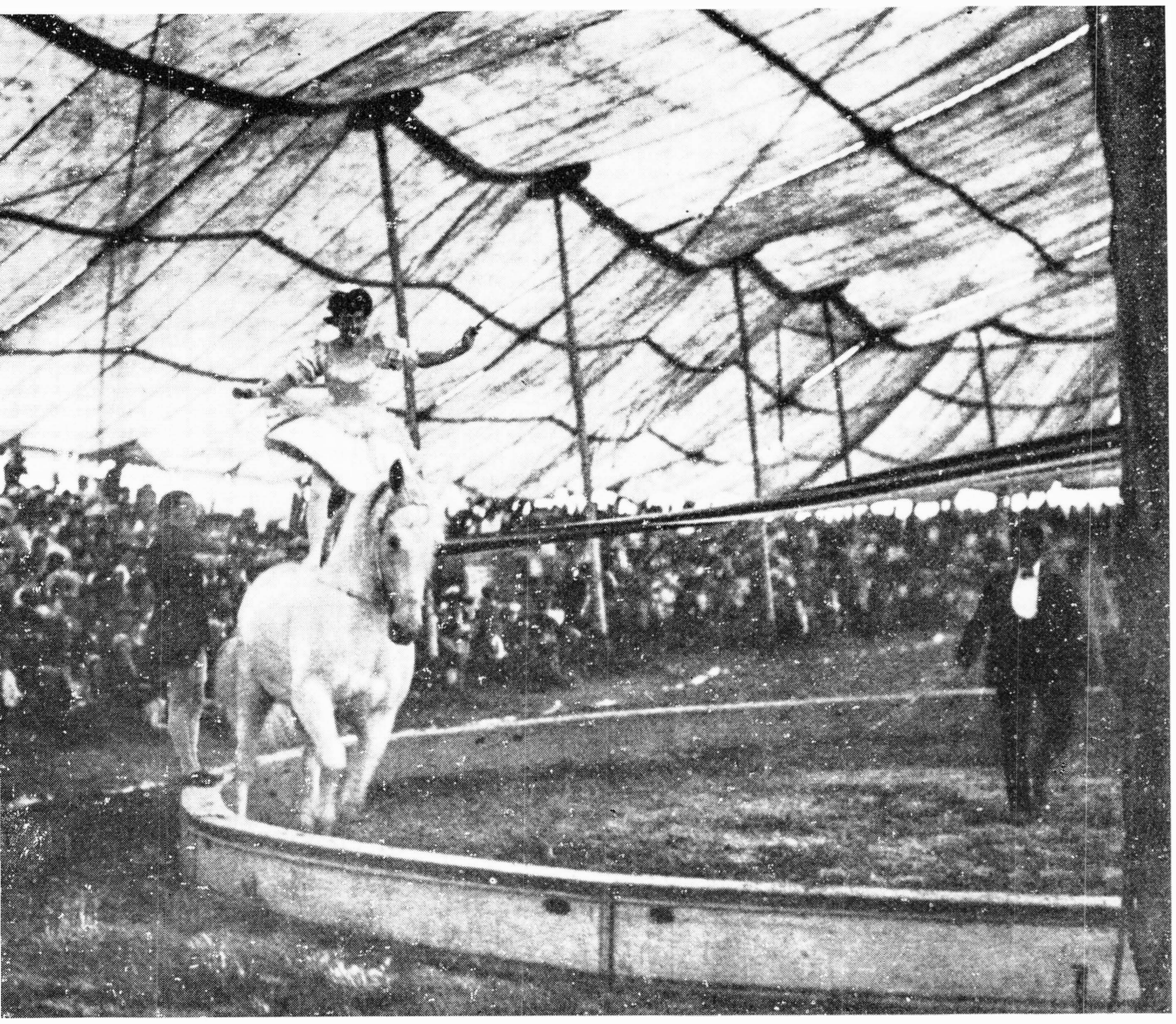


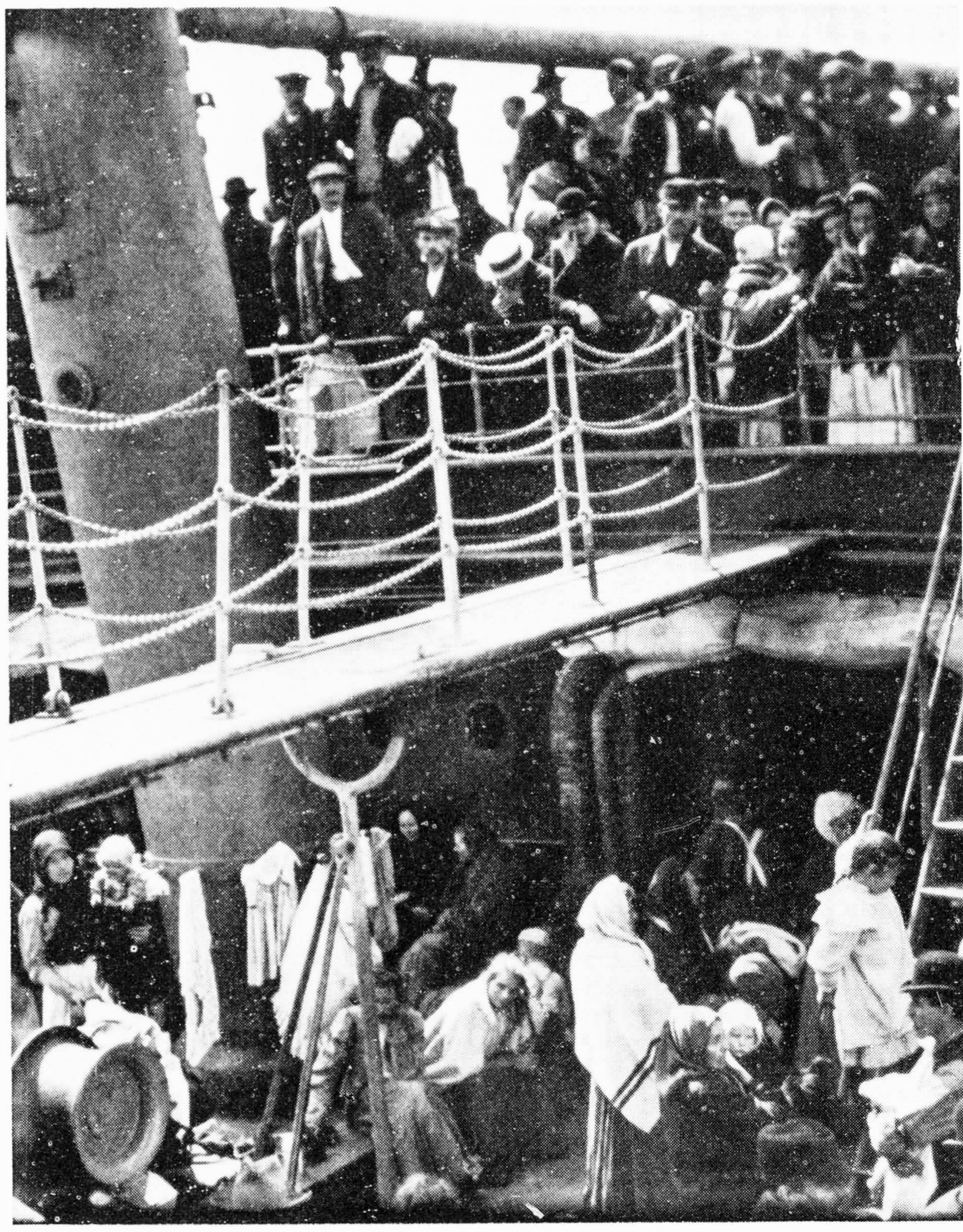
HAMBURG·KUNSTHALLE

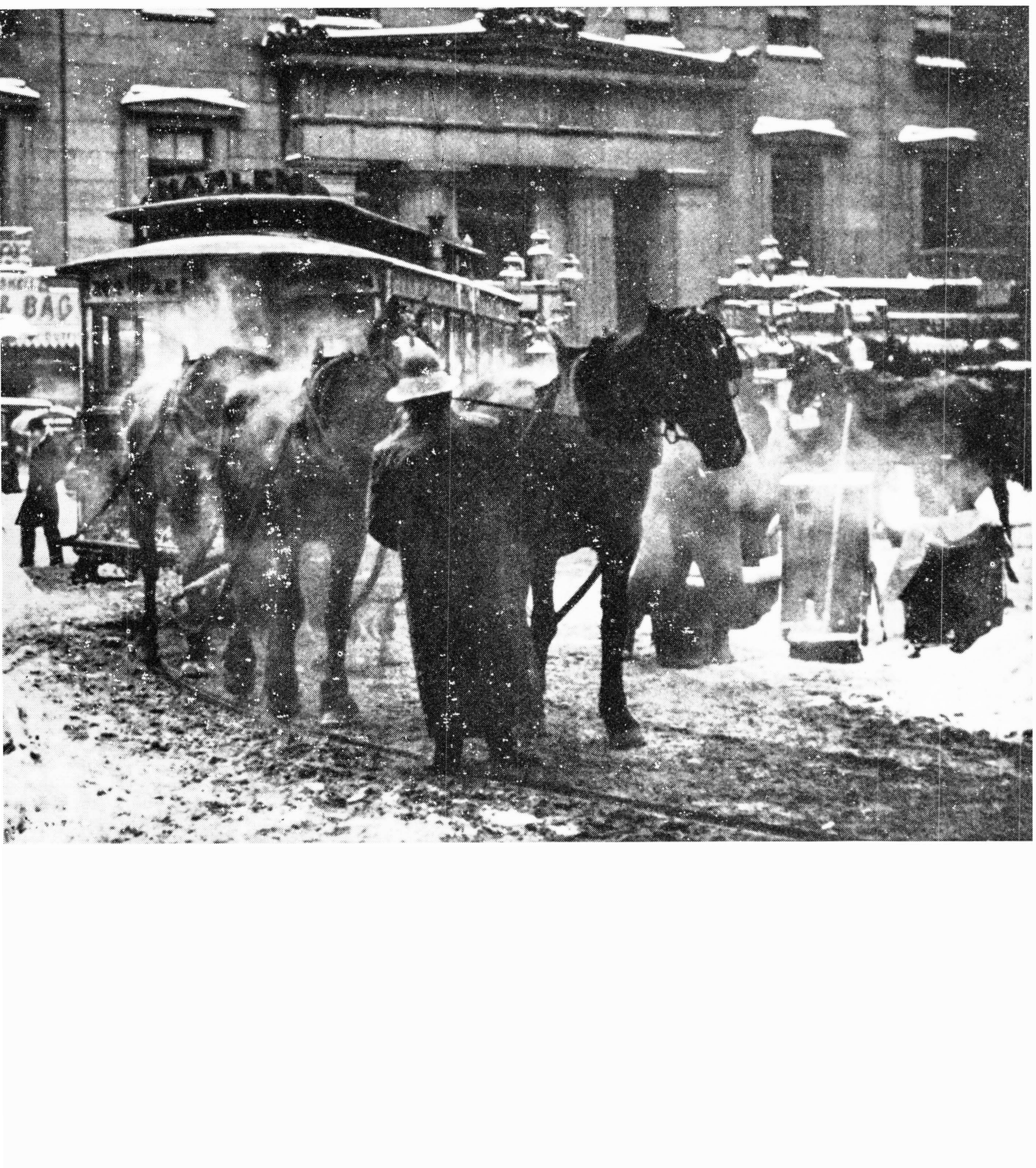
7. internationale
AUSSTELLUNG
von
KUNST-PHOTOGRAPHIEN
1899

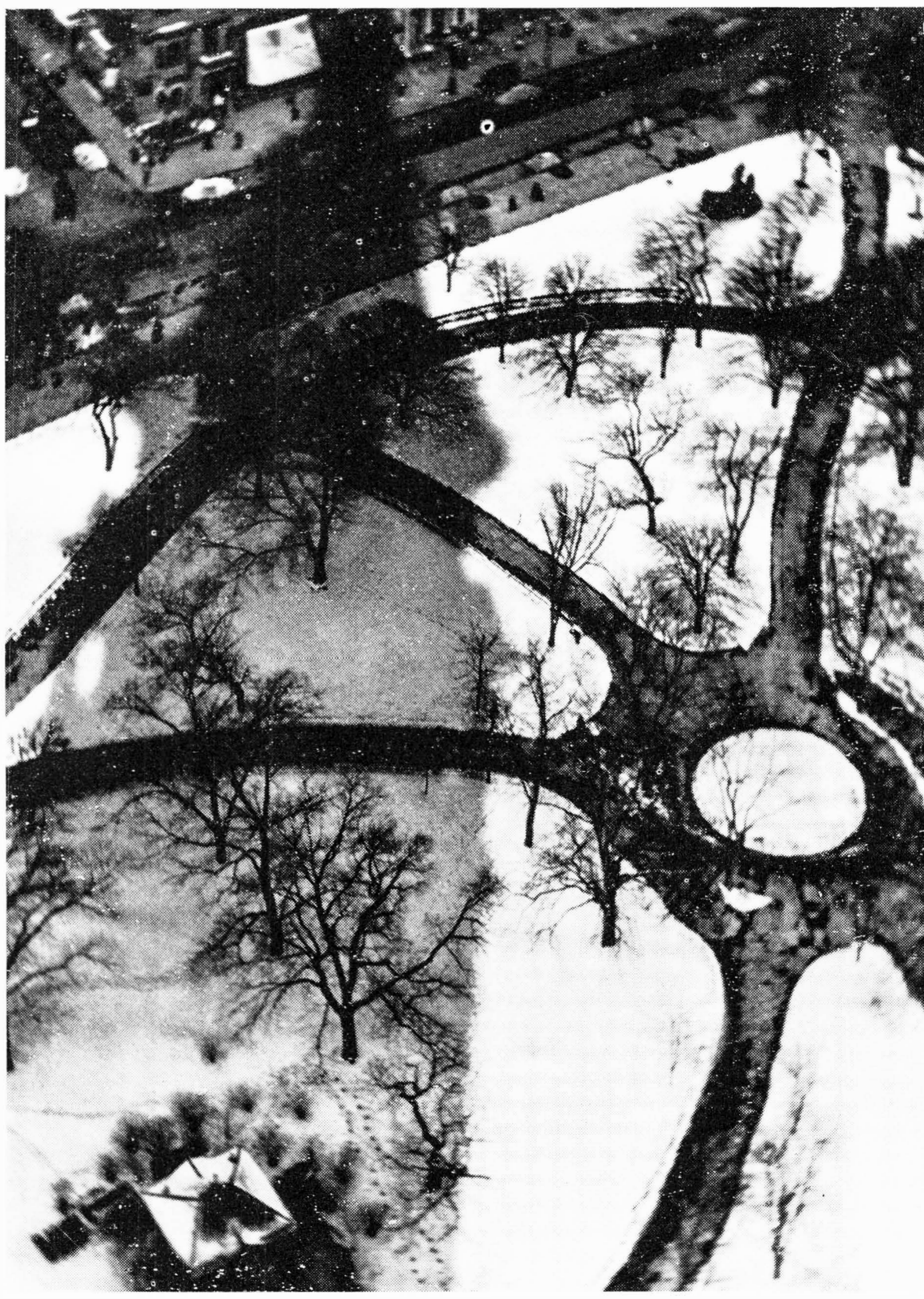
Ges. z. Foerderung d. Amateur-Photographie











305 HARRY C. RUBINCAM. Circus rider. Photogravure, 1905
306 ALFRED STIEGLITZ. 'The Steerage'. Photogravure, 1907
307 ALFRED STIEGLITZ. 'The Terminal'. Photogravure, 1893
308 ALVIN LANGDON COBURN. 'The Octopus', New York. Photogravure, 1912

Part VI

SOME APPLICATIONS OF PHOTOGRAPHY

39 Aerial photography

Foreseeing that aerial photography would revolutionize map-making and military reconnaissance **NADAR**, already for some years a keen balloonist, took out a patent on 23 October 1858. His earliest attempts at photography from a balloon in 1855 had resulted in badly fogged plates, but he persisted, and eventually chance revealed the cause of the difficulty. In the early winter of 1858[1] after yet another failure, Nadar landed at the village of Petit-Bicêtre near Paris, where he was obliged to stay overnight. Finding that the gas had contracted during the cold night, the next morning's ascent was made with the valve closed. To Nadar's delight a distinct though faint image was recorded–an Ambrotype–from a height of about 80 metres. The cause of the previous failures was now evident to him: hydrogen sulphide escaping through the open valve had fogged the collodion plates. Yet despite this knowledge, Nadar achieved no further successful pictures until 1862, after which for some years he took good bird's-eye views of Paris from a captive balloon from heights up to 1,500 ft. Most of them cannot be before 1865 since they show boulevards and avenues which Pl 312 had not been built before that date. This feat afforded Daumier–strangely an opponent of photography–an opportunity to make fun of Nadar's claim to 'raise photography to the height of art'. Pl 311 The phrase 'élever la photographie à la hauteur de l'art' had been coined by Nadar in an advertisement in *Le Journal Amusant*, 6 November 1858, for which magazine he had just started a new series of caricatures. The camera was not attached to a tripod as shown in Daumier's cartoon, but fixed in the side of the balloon basket.

Nadar, a firm believer in controllable heavier-than-air flying machines driven by a screw motor (helicopter), in 1863 had a gigantic balloon constructed, three times larger than any other in Europe, with a circumference of nearly 300 ft, in order to earn money by exhibitions and public ascents, the proceeds to be used for the development of heavier-than-air craft.

The red-painted wickerwork car of 'Le Géant' was a little two-storeyed house 13 ft high. It contained four beds, a lavatory, a photographic dark-room, and a small lithographic press to print short accounts of the progress of the flight, which were thrown overboard, together with advertising leaflets of firms who paid for this service. Very practical also was the arrangement of having wheels for attachment to the car on landing, to convert the balloon basket into a horse-drawn vehicle.[2] The overall height was only some 45 ft less than Notre Dame cathedral.

The first ascent of 'Le Géant' with 15 passengers took place on 4 October 1863 from the Champ de Mars in the presence of 80–100,000 spectators. The second ascent was made from the same place a fortnight later in the presence of the Emperor, the

King of Greece, and a still larger crowd, this time with nine passengers on board, including Mme Nadar. The following day they crash-landed in Hanover, and sustained some injuries. The same month Nadar founded the Aeronautical Society, the periodical *L'Aéronaute*, and introduced the term 'aviation' instead of 'aerostatics'. His friend Jules Verne, a member of the new society, portrayed Nadar under the anagram Ardan as the hero of his famous science-fiction book *Voyage de la Terre à la Lune* (1865). Nadar never recovered his expenses on 'Le Géant'.

Meanwhile, on 13 October 1860, J. W. BLACK took the first really satisfactory aerial photograph–a view of Boston from a tethered balloon at the height of 1,200 ft.[3] Only one of eight photographs was successful. In going higher in the free balloon, Black and his navigator Samuel A. King encountered the same difficulty as Nadar had. The gas expanded as they rose, and escaping from the open neck of the balloon ruined all the plates.

It has often been stated that during the American Civil War Professor Thaddeus S. C. Lowe photographed from a reconnaissance balloon at the siege of Richmond, but Lowe made drawings, and the story has been entirely refuted in *Image*, No. 65.

In England in 1863 the photographer HENRY NEGRETTI, founder of Negretti & Zambra the scientific instrument makers in London, and JAMES GLAISHER, director of the meteorological department of Greenwich Observatory, photographed from free balloons, the former at nearly 4,000 ft, the latter at 2,000 ft. They and other experimenters found it easier to photograph from a free balloon than from a captive one in which the car (except in a dead calm) is tossed about more violently than any ship and with equally unpleasant results for the occupants; however a free balloon oscillates comparatively slowly, and provided it is high enough the apparent movement of objects below is not too rapid for exposures of a fraction of a second.

Despite these isolated successful results, aeronautical photography made no real progress until the introduction of factory-produced gelatine dry plates in 1878, which were twenty times faster than the old wet collodion plates. Working with gelatine plates in June 1880 PAUL DESMARETS obtained two remarkable views of Rouen from a free balloon at a height of 4,200 ft, with an exposure of $\frac{1}{20}$ second. Even these views were surpassed by the photographs of JACQUES DUCOM made five years later in a balloon navigated by Gaston Tissandier. Ducom's view of the Île Saint-Louis, Paris, from 1,800 ft leaves absolutely nothing to be desired. Through a magnifying glass people can be counted on the bridge. The exposure of this and the other photographs taken on this flight was $\frac{1}{50}$ second, using a specially constructed guillotine shutter which was opened pneumatically and closed automatically with a rubber spring.

A more economical method of aerial photography was patented in 1877 by WALTER WOODBURY, a prolific inventor in the photographic field. He attached the photographic apparatus to a small unmanned balloon. Inside the camera was a roll-holder with a band of sensitive paper moved by clockwork. This and the revolving disk shutter of the lens were both controlled by an electro-magnet connected by an electric wire to a small battery on the ground.

Pl 309 In 1887 ARTHUR BATUT, a Belgian amateur photographer, introduced kite photography, a kite being both much cheaper and steadier than a balloon. Batut's kite was 8 ft long with a steadying tail of 39 ft. Its raising power was so efficient that the kite could carry apparatus weighing nearly as much as itself (4 lb.) as well as a cord 725 ft long weighing another 4 lb.

The specially designed light-weight aerial camera was fitted with a guillotine shutter giving exposures of $\frac{1}{100}$ to $\frac{1}{150}$ second. The shutter was operated by a slow-burning tinder time-fuse, thus avoiding the considerable weight of an electric wire. As a rule it took only a couple of minutes for the kite to rise to about 260 ft, and the time-fuse, which was lit at the take-off, burned for four minutes. The negative material was Balagny's flexible cut-film, and the moment the exposure had been made a paper streamer was released as a sign to those below that the kite could be hauled down.

For the photographs to be of any value to the surveyor and meteorologist it was essential, of course, to establish the exact height at which they were taken. This data Batut obtained by attaching to the camera a small aneroid barometer with a tiny dark chamber behind it with a shutter covering an opening 1 mm. in diameter. At the moment the photograph was taken this shutter opened too, and the shadow of the two hands of the barometer was projected on to a piece of sensitive paper: the index hand having been set on the ground, the barometric hand showed the air pressure at the height at which the picture was taken. From this the actual height could be calculated, and hence the scale of objects in the photograph. Batut's kite photograph of Labruguière taken on 29 March 1889 from a height of 300 ft clearly shows that his invention was not a daydream but an efficient apparatus.[4] Pl 310

Ten years later L. Gaumont of Paris made a still more elaborate kite camera for A. LAWRENCE ROTCH of the Blue Hill Meteorological Observatory near Boston, Mass. It was primarily intended for photographing the under-surface of clouds. By means of a clockwork device successive exposures were made on a roll of film at predetermined intervals.

Twentieth-century aerial photography had to keep pace with the needs of the rapidly increasing speeds of airships, aeroplanes, and finally rockets. Fast shutters, better lenses, film material and above all miniature cameras, all played an essential part in this development.

Early in 1909 the first photographs from an aeroplane were taken over Mourmillon at a height of 100 to 200 ft by a Frenchman named MAURISSE. The results were blurred. On 15 April the same year an unnamed photographer flying with Wilbur Wright at Centocelle near Rome took the first cinematograph pictures from an aeroplane. During the First World War reconnaissance photography from airships and aeroplanes assumed the greatest importance and was practised by all the combatants, most of whom had had from the 1880s onward a special balloon corps with photographic staff. The newly constituted Royal Flying Corps took its first air photographs of the war over enemy positions at the Battle of the Aisne in September 1914. The results, though not completely successful, were encouraging, and in January 1915 an experimental R.F.C. photographic unit was formed at Pinehurst near Farnborough under Lieut. Moore-Brabazon (later Lord Brabazon) to investigate the most suitable cameras and methods for aerial photography. The increasing demand for aerial photographs led in mid-1915 to formal training of photographers both at Pinehurst and at the Regent Street Polytechnic, London. Late in 1917 the R.F.C. School of Photography moved into new buildings at Farnborough, where it remained for the next thirty years.[5]

Rocket photography is not a novel idea, though it is only since the Second World War that the technique has been perfected. A Frenchman named AMÉDÉE DENISE actually constructed and tested such an apparatus in 1888. A cylindrical camera with twelve lenses round its circumference, and set to take all the photographs simultaneously on twelve plates arranged together at the highest point reached, was shot up attached to a rocket. The exposure was made by a time-fuse; after this a parachute brought the apparatus down to earth.[6]

ALFRED MAUL in 1903 and 1905 took out German patents for his photo-rocket. The missile weighed 55 lb. and was 19 ft 9 in. long. The nose-cone which contained the camera was 14 in. in diameter. After the exposure, which was timed to take place 8 seconds after firing at an altitude of 2,600 ft, the nose-cone floated down to earth attached to a parachute. Still more astonishing than the rocket design is the fact that it worked. A number of Maul's rocket photographs taken in 1909 were published in *The Illustrated London News*, with others showing the setting up of the rocket on its launching pad, the blast-off, and the recovery of the nose-cone.[7]

40 *Under-water photography*[1]

One stormy day in the winter of 1856 the engineer WILLIAM THOMPSON of Weymouth and his friend Kenyon gazed disconsolately out of the window of the Portland Ferry Bridge House in which they had been weatherbound for hours, two miles from home and dinner. Through the rain streaming down the windowpanes Thompson could just see the swollen river Wey rushing through the arches of the bridge, and having nothing better to do he began to wonder what would happen if the bridge were swept away. No doubt divers would be sent down to examine the masonry under the water, but how were they to give a reliable description of its condition? While he pondered, an idea suddenly struck him–a keen amateur photographer. Of course, the camera might provide the solution to the problem, but how? He asked Kenyon, and while they waited for the weather to clear up they began devising a plan for photographing under water. This they tested at the earliest opportunity, in February 1856.

They constructed a watertight box large enough to contain the camera, and padded inside. One end of the box consisted of a sheet of plate glass. Outside this they fixed a heavy wooden drop shutter with a long string to raise it. The box was clamped to a heavy iron tripod.

After focusing the lens at 10 yards and inserting a 5 in. × 4 in. dry collodion plate in the camera, the whole apparatus was lashed to the stern of a boat and the two experimenters rowed out into Weymouth Bay. Here they carefully lowered the apparatus with a rope on to the sea-bed–a depth of 18 ft–pulled the shutter-string, held it for ten minutes hoping for the best, then released it and drew up the apparatus. To their dismay they found that the pressure of the water had caused a leak and the camera was full of sea water. Nevertheless Thompson succeeded in developing a rather weak image of sand and boulders covered with seaweed. Strange to say, the image was not inverted; the thick plate glass in front of the lens having acted as a reversing mirror.

In sending to the Society of Arts, London, a print of this first under-water photograph ever taken, Thompson wrote: 'This application of photography may prove of incalculable benefit to science. Should a pier of a bridge require to be examined, you have but to set your camera, and you will obtain a sketch of the pier, with any dilapidations, and the engineer will thus obtain far better information than he could from any report made by a diver.'

Ten years later a French photographer named BAZIN claimed to take sharp and well defined photographs of sunken objects by electric light from a Bunsen battery.

Bazin went down to the sea-bed in a sort of diving-bell, a sheet-iron box with watertight portholes through which he photographed. His purpose was to make the reclamation of sunken ships easier, and he could safely remain in his submarine studio for about ten minutes at depths approaching 300 ft.

Pl 313 About 1893 LOUIS BOUTAN, professor at the Zoological Station at Banyuls-sur-Mer, Eastern Pyrenees, went down in a diving suit to explore the sea-bed with a camera. He adapted a magazine camera with a fixed-focus lens for distances of over 10 feet and containing six gelatine dry plates, by screwing it into a watertight metal box sealed with rubber joints. There were glazed openings in front of the lens and viewfinder. Releasing the shutter and changing the plates was done by levers projecting through the protective box. At least ten minutes' exposure was necessary, sometimes half-an-hour, depending on the depth of the water. Since waterproof watches did not yet exist, Boutan signalled on the safety rope to a man in the boat when the exposure began, and he in turn signalled in the same way when the time was up.

Manœuvring this cumbersome apparatus was very exhausting until Boutan had the idea of attaching it to a barrel of air acting as a float.

For photographing fish in fairly shallow water a white background was taken down, and scraps of food scattered in front of it to attract the fish. At greater depths only seascapes, close-ups of anemones and seaweed, etc., could be taken.

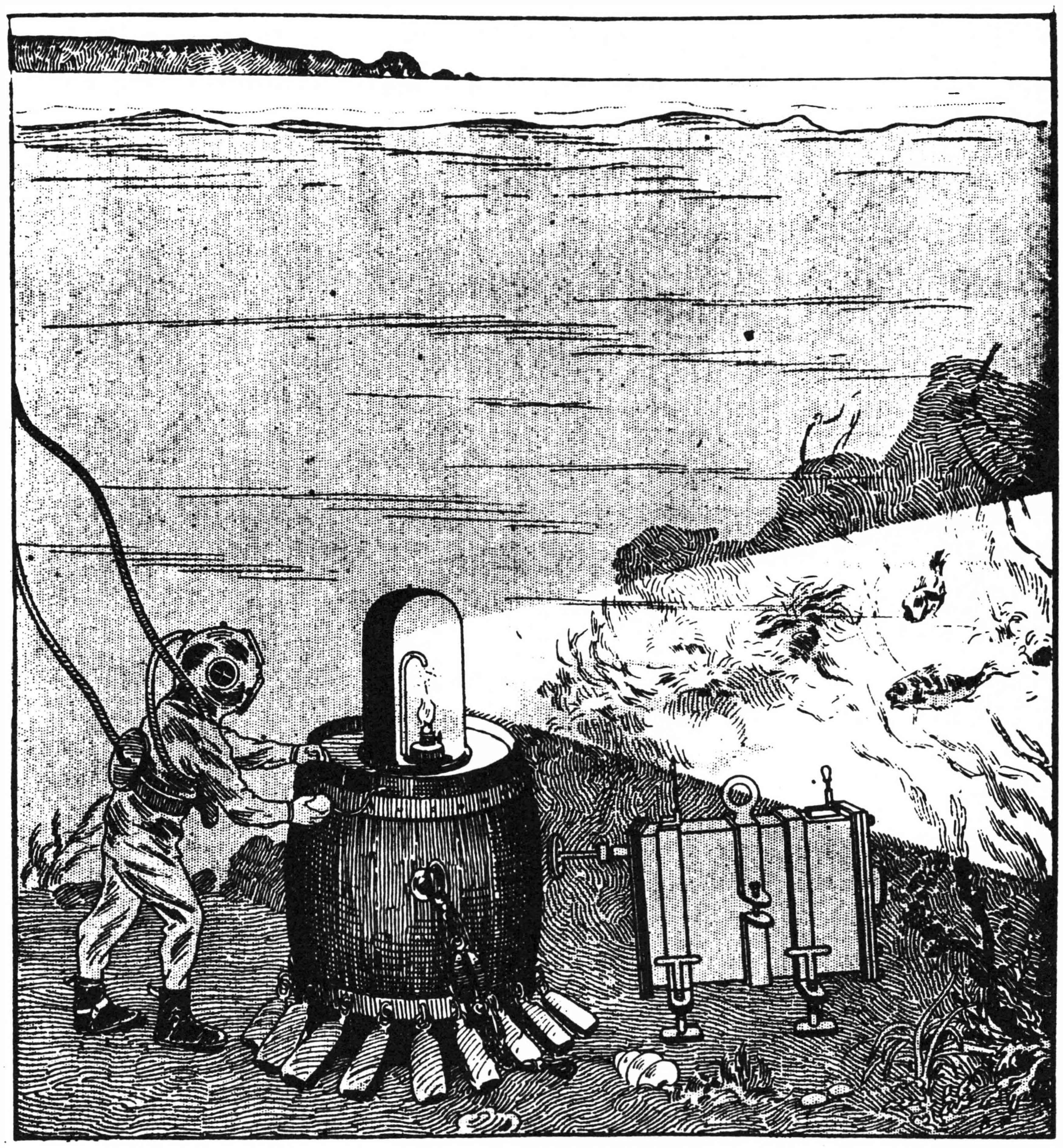


Fig 67 *L. Boutan. Photographing by magnesium light under water, 1893*

Finding it impossible to obtain satisfactory results by natural light beyond a depth of about 15 feet on account of the long exposures, Boutan had recourse to artificial light. At first he used a lamp designed in 1893 by his friend Chauffour, an electrical engineer (see p. 429). It was a kind of forerunner of the magnesium flash bulb, in a watertight casing, the only snag being that it often became overheated and burst.

Boutan then tried taking down a 50-gallon barrel full of air supplemented with oxygen, having at the top a lighted spirit lamp under a glass dome. Into this lamp, magnesium powder could be injected through a rubber tube, to produce a brilliant but short-lived light. This light source was more reliable than the previous one, but still deficient in power, for the absorption of light by sea water is enormous. Even in the Mediterranean–the most transparent water–$\frac{7}{8}$ of the light is lost at a distance of about 35 ft. Fig 67

In 1899 a more ambitious lighting system was tried. A battery of accumulators consisting of sixty specially constructed elements, charged from a dynamo, was placed on board a small sailing boat, while the light source was let down to the sea-bed. It consisted of two projectors formed by carbon-arc lamps with a lens and reflector, enclosed in hermetically-sealed casings. The power for these submarine searchlights was supplied through cables from the battery on the boat. The camera was fitted with an electro-magnetic shutter operated from the boat. Although instantaneous pictures could be taken and greater depths explored, the expense and difficulty of manipulating this lighting system rendered it impracticable for anything but experimental work.

All experimenters in under-water photography following Bazin and Boutan used either a diving-bell or a diving suit until 1925 when COMMANDANT LE PRIEUR invented the first self-contained diving gear, which was perfected in 1933.

Great strides have been made since the first book on under-water photography was published in 1900 by Boutan.[2] His prophecy that one day under-water photography would be practised by amateurs and become a new sport has come true.

41 *Photography of criminals*[1]

' "Sitting for my portrait!" said Mr Pickwick. "Having your likeness taken, sir", replied the stout turnkey. "We're capital hands at likenesses here. Take 'em in no time, and always exact. Walk in, sir, and make yourself at home." Mr Pickwick complied with the invitation, and sat himself down'.

This is what befell Mr Samuel Pickwick in the Fleet Prison, where he found himself at the instigation of the widow Bardell, and this method of portrait taking was described by his creator Charles Dickens two years before photography was made public. Mr Pickwick found himself in the centre of a crowd of turnkeys and other gaol officials, whose business it was to stare at him until they were absolutely certain of knowing him when present, and–what was more important–of being able to describe him if absent. This kind of 'portraiture' was no doubt a greater torment to the sitter than the photographic process universally adopted for such purposes in English prisons over thirty years later.

The first photograph taken in a prison was, strange to say, not for police use but for political propaganda. During the imprisonment of Daniel O'Connell, M.P., in Richmond Gaol, Dublin, in spring 1844, he and the other Young Ireland leaders were daguerreotyped, and lithographs copied from the portraits were widely sold to their supporters. The same thing was done four years later when William Smith O'Brien, M.P., and Thomas F. Meagher were in Clonmel Gaol charged with high treason. The daguerreotype taken by 'Professor' Glückmann, a Dublin professional, shows the two rebel leaders with a prison warder and a soldier.

The application of photography to police purposes originated with the Swiss Federal Government, which in autumn 1852 authorized the Department of Justice and Police to have photographs taken of all vagrant beggars found in other Cantons than their own, for, it was stated, the verbal descriptions hitherto relied upon were insufficient to identify the offenders.

Two years later the idea was taken up in England. James Anthony Gardner, Governor of Bristol Gaol, had a photograph made of every prisoner in his charge and sent a copy to every prison in the country in order to find out if his prisoners were known in any of them. By doing this he ascertained that certain men were being treated as first offenders who were in fact 'old lags'. In December 1854 Gardner issued a circular recommending the adoption of this plan at all British prisons. However, apart from Bristol Gaol, we know for certain of only one other prison where the taking of photographs was introduced, and that was quite unofficial. William Garbutt, Deputy Governor of Derby Gaol, and an enthusiastic amateur photographer, from 1856 to 1873 took portraits of suspected persons as well as of convicted prisoners, and pasted them in an album, appending brief case-histories of each sitter.

The first public wanted person's notice with photograph was made following the suggestion of the Frenchman Moreau-Christophe in 1854. The following year Lerebours' photograph of Pianort, who had made an assassination attempt on Napoleon III, was circulated to French and foreign police forces.

The first time that a photograph of a wanted person was bill-posted by the police all over England was in 1861. The man sought had absconded with £40,000. A private photograph was used, in which the offender smiled amiably, hat in hand, upon all who read the notice that £100 reward would be paid upon his apprehension. A month later the defrauder was recognized from this photograph by an English detective in Turin, and duly arrested. In spite of this success, it was not until 1865 that a Select Committee of the House of Lords recommended to the Home Secretary the universal adoption of prison photography, and another five years went by before the Prevention of Crimes Act was passed, making compulsory the photographing of every prisoner in England and Wales. During the year 1871–72 a total of 30,463 portraits were received at Scotland Yard from County and Borough prisons, and 375 arrests were made in consequence of the criminals having been identified by photographs. The cost of photographing was low compared with its great utility. From the time the Act came into operation in November 1871 up to the end of 1873, the portraits of all prisoners in the 115 gaols of England and Wales cost £2,948 18*s*. 0*d*.

Of course, many prisoners objected to being placed on record in this way, as illustrated in Luke Fildes' woodcut of 1873. Others, knowing the uselessness of resistance, meekly submitted, but when the lens was uncapped, pulled a frightful grimace to make themselves unrecognizable. So far, only full-face portraits were taken: after about 1900 profile portraits were also taken to make identification still easier. Pl 314

It was not long, however, before it became evident that photographs alone were insufficient proof of identity. An outstanding example of this is the famous Tichborne case. In 1867 Arthur Orton claimed to be Sir Roger Tichborne, who was declared lost at sea thirteen years before, and claimed the baronetcy and estates worth about £24,000 a year. Though accepted by Lady Tichborne, who had advertised for her missing son in 1865, no other members of the family believed in Orton, and they resisted his claim in court. Old photographs of Orton were compared with those of the lost Tichborne, and with his present appearance; physiognomists were consulted, and hotly disputing each others' opinion, published polemical pamphlets against one another. Out of 150 witnesses, over 100 swore that the claimant was *not* Tichborne, but the remainder were equally positive about his genuineness. After nearly four years–the longest trial known in England–Arthur Orton was sentenced to fourteen years' hard labour for perjury and forgery, and after serving ten years was released on ticket-of-leave. He continued protesting his innocence, which was still believed in by many people, until three years before his death in 1898 when he published his confession in *The People*.

In other countries, too, the authorities sooner or later came to the conclusion that some other identification method was necessary in addition to photographs. The Prefect of the St Petersburg police, for instance, had circulated the portrait of a certain Nihilist, and to make doubly sure, sent six different carte-de-visite photographs of him. Before long the Prefect received a communication from a police superintendent: 'Your Excellency, I have the honour to report that I have already arrested four of the atrocious criminals whose portraits you recently sent, and confidently hope to capture the other two very shortly.'

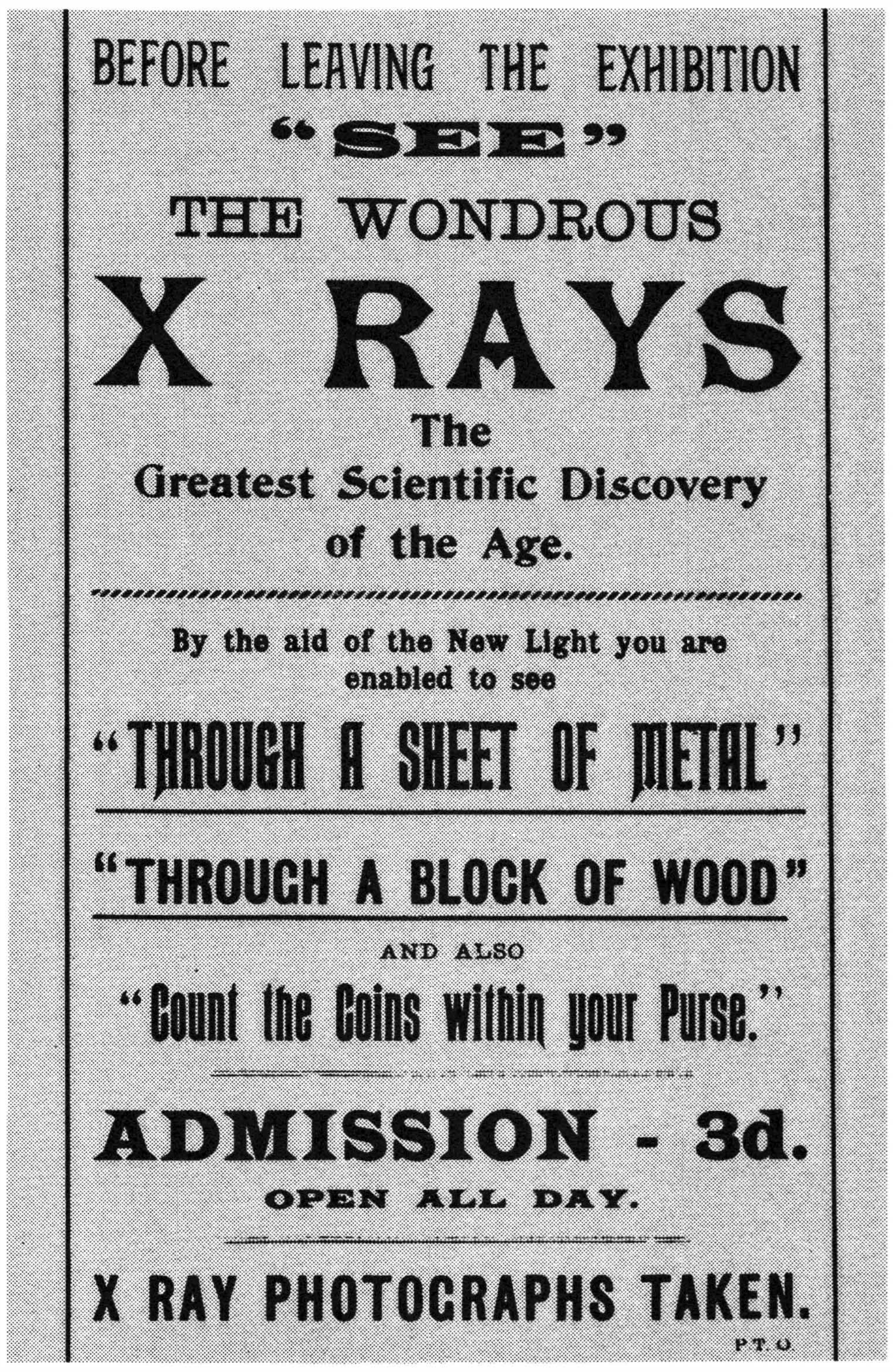
In France, Germany, Spain, Italy and Denmark an anthropometrical system consisting of measuring certain bones which do not alter after maturity was adopted in the early 1880s. Alphonse Bertillon, a Parisian police officer, in 1880 devised this method for identification by measuring the length and width of the head, the length of the middle and little fingers of the left hand, of the left foot and forearm, and the height of the body. Examination of 50,000 people showed that no two had the same measurements. By the Bertillon method, photographs were divided into three classes according to height–tall, medium, or short–and each of these classes was subdivided again and again according to the other measurements. The measurements of an arrested person were given priority over comparison of photographs, thus avoiding mistaken identity due to strong chance resemblance–or a false name which prisoners frequently give.

In England a different foolproof system of additional identification was introduced, which originated in Bengal. In 1858 Sir William J. Herschel (son of Sir John Herschel), then a magistrate in Bengal, had recourse to finger-printing for its deterrent effect on the practice of repudiating signatures. Having confirmed during many years' study that no change takes place in the pattern of the ridges in the skin, Herschel used his system officially in his own district at Hooghly until his retirement in 1878. Fifteen years later the Bengal Government adopted the method and soon finger-printing became general practice in India, a system of classification of fingerprints according to their pattern having meanwhile been worked out by Sir Edward Henry, who wrote a text book. When Henry came to England as Commissioner of the London Metropolitan Police in 1901, he introduced finger-printing at Scotland Yard.

42 Medical photography

A detailed account of early applications of photography to medicine and surgery was compiled by Alison Gernsheim and published with many illustrations in 1961. The subject is considered too specialized for inclusion in the present *History of Photography*, and those readers interested in it are referred to the original publication.[1]

X-ray Photography. In December 1895 PROFESSOR WILHELM KONRAD RÖNTGEN of Würzburg University published a paper 'On a new kind of rays', describing his experiments with the so-called X-rays which penetrate a large number of substances opaque to ordinary light. Röntgen's discovery was made accidentally during experiments with a Crookes' vacuum tube contained in a cardboard box. It caused an enormous sensation, comparable with that aroused by the announcement of the daguerreotype.



BEFORE LEAVING THE EXHIBITION

"SEE"

THE WONDROUS

X RAYS

The
Greatest Scientific Discovery
of the Age.

By the aid of the New Light you are
enabled to see

"THROUGH A SHEET OF METAL"

"THROUGH A BLOCK OF WOOD"

AND ALSO

"Count the Coins within your Purse."

ADMISSION - 3d.

OPEN ALL DAY.

X RAY PHOTOGRAPHS TAKEN.

P.T.O.

Fig 68 Advertisement of an X-ray exhibition, 1896

Radiographical examination followed almost immediately: early in 1896 a Viennese physician detected a gallstone. One of the earliest diagnoses in Great Britain was the detection of part of a needle in a woman's finger, which was operated on at the Royal Free Hospital, London, at the beginning of March 1896.

Gradually other uses of X-rays were introduced: the detection of flaws in metal, the examination of paintings, and in crystallography.

Apart from these serious uses, X-rays were in the early days an entertainment.
Fig 68 Apparatus was installed in many a popular exhibition, such as one at the Crystal
Pl 315 Palace. A favourite demonstration subject was a hand wearing jewellery, or a purse
containing coins.

Part VII

THE EVOLUTION OF COLOUR PHOTOGRAPHY

43 The evolution of colour photography

Right from the introduction of photography a certain disappointment was felt at its inability to record colours, which were instead translated into monochrome tones. Yet, having achieved the exact representation of nature with all its details, it was realized that the attainment of colour was only a matter of time–though its advent came much later than expected.

Colour was at first particularly missed in portraiture, for the public, accustomed to miniatures, preferred 'twopenny coloured' to 'penny plain'. Miniature painters, finding themselves out of work through the popularity of the daguerreotype, soon fulfilled the demand by tinting daguerreotypes and occassionally painting over paper photographs.

Three-colour Photography. With the exception of the direct colour processes of Niépce de Saint-Victor and Gabriel Lippmann and the diffraction system of Professor R. W. Wood, three-colour photography is the principle underlying all processes. It is based on the theory that by the use of only three primary colours, all the shades of nature can be reproduced. This is achieved either by superimposing, i.e. adding, three lights–red, green and blue-violet–(additive optical synthesis), or by superimposing three pigments–red, yellow and blue–on paper or glass. Since the pigments absorb or subtract from light all colours except their own, which they reflect, the latter principle constitutes a subtractive colour synthesis.

In a lecture on the Young/Helmholtz theory of colour vision at the Royal Institution, London, in May 1861 (SIR) JAMES CLERK-MAXWELL demonstrated the correctness of the additive analysis and synthesis. THOMAS SUTTON had prepared for him three separation negatives of a striped coloured ribbon taken through glass cells containing red, green and blue-violet solutions of metallic salts, which acted as filters. Diapositives of these were projected during the lecture from three magic-lanterns through the same filters, in register on a white screen, where they synthesized into a colour image. Clerk-Maxwell obviously had not complete confidence in the colour theory, for Sutton relates[1] that he had been asked to prepare a fourth plate taken through a yellow filter, which was intended as a possible alternative to the red filter negative. Though the colour reproduction of the ribbon was far from perfect, with this experiment Clerk-Maxwell laid the foundation of three-colour photography by the additive process.

Unaware of this LOUIS DUCOS DU HAURON, a French pianist, and HENRY COLLEN, the English miniature painter and calotypist, came forward with suggestions for additive processes in 1862 and 1865 respectively. Both, however, were founded on

Sir David Brewster's theory of red, blue and yellow as primary colours, which is valid for pigments only (subtractive colour processes).

Ducos du Hauron proposed the taking of three separation negatives behind red, blue and yellow filters, and visually superimposing three diapositives behind identical filters in a viewing instrument or chromoscope.

Collen suggested[2] taking three separation negatives, one coated with a substance sensitive to red only, one to blue and one to yellow. From these he recommended making colour diapositives, each combination of two superimposed negatives to produce the colour of the third: and finally to superimpose the three diapositives upon each other. But, as Collen realized, there were no substances sensitive to one colour only.

In November 1868 du Hauron applied for a patent for colour processes by the additive and subtractive methods, which with certain modifications formed the basis of all later methods. In the former, instead of re-forming the picture by projecting a positive transparency from each separation in register with the others upon the same surface, each illuminated by light of a single colour–as Clerk-Maxwell had demonstrated–du Hauron suggested making the triple operation on a plate through a glass screen covered with minute red, blue and yellow dots or lines. His book *Les Couleurs en Photographie: Solution du Problème* (1869) explained this technique in greater detail, but a full description of this first idea of a screen-plate process had to wait for twenty-eight years[3]–after it had already been put to practical use by other inventors–with the important difference of using the correct primary colours on the screen.

In du Hauron's subtractive method three separation negatives were taken behind green, orange-red and blue-violet filters; from these, positives were printed on three thin sheets of bichromated gelatine incorporating carbon pigments of red, blue and yellow colour respectively, i.e. the complementary colours to those by which the negatives were taken. On treatment with hot water, the parts of the gelatine unaffected by light were washed away, leaving red, blue and yellow carbon prints which, when mounted superimposed, formed a colour photograph. Either colour transparencies or colour prints could be made by this method, depending on whether the carbon prints were mounted on glass or on paper.

CHARLES CROS, a doctor and writer, had like du Hauron been working independently on the theory of three-colour photography for several years. By an extraordinary coincidence he published in *Le Monde* the correct principle of the subtractive colour method only two days after the granting of Ducos du Hauron's patent on 23 February 1869. A more detailed account appeared in a pamphlet the same year.[4]

Like all experimenters working on the problem of colour photography, Ducos du Hauron was seriously impeded by the comparative insensitivity of photographic negative materials to colours other than blue and violet. Even the most correct theory was bound to lead to unbalanced colour pictures until good panchromatic material was available. Ducos du Hauron's earliest surviving colour photograph, a view of Angoulême, dates from 1877, and though taken after the introduction of certain dyestuffs which had the effect of increasing the colour range, the picture is far from perfect. The unequal reaction of the sensitive collodion coating to the three primary colours was stated by du Hauron[5] to be 25–30 minutes behind the red filter, 2–3 minutes behind the green filter, and only 1–2 seconds with the blue-violet filter.

HERMANN WILHELM VOGEL's pioneer work in orthochromatism (see page 332) led a number of other investigators to experiment on similar lines, with the result that through new and better colour sensitizers the photographic plate was by degrees made more sensitive to green, yellow, and orange. Orthochromatic plates were, however, still comparatively insensitive to red and over-sensitive to blue. It was not until 1906 that the first truly panchromatic plates (i.e. sensitive to all colours of the spectrum) were commercially introduced by Wratten & Wainwright of London, after new I. G. Farben dyestuffs had extended the sensitivity of the photographic emulsion to red.

The various apparatus invented by FREDERIC EUGENE IVES of Philadelphia first made the realization of colour photography a practical proposition. In his Photochromoscope camera (1893) three separation negatives were taken in succession on one plate by means of a repeating back containing red, green and blue-violet filters. From these, diapositives were made by contact printing. When cut into the three separations and laid on the Kromskop viewing instrument (1892) containing filters of the same colours and mirrors, the optically superimposed Kromograms appear in perfect colour.

In 1893 Ives brought out stereo versions of these instruments which, like the monocular version, were made by the Photochromoscope Syndicate in London; in these pictures are seen in relief. In 1895 came the Projection Kromskop in which the three diapositives are superimposed by means of triple projection behind red, green and blue-violet filters in conjunction with an ordinary magic-lantern. This was followed in 1900 by a Diffraction Chromoscope and a one-shot colour camera in which, by means of built-in filters and mirrors, the three separation negatives were obtained in one exposure. In the latter, however, he had been preceded by Ducos du Hauron, who called his prototype of all one-shot colour cameras Photochromscope. The Mélanochromoscope introduced by du Hauron in 1899 was a combined taking and viewing instrument for three-colour photographs. In this apparatus the light rays entering the lens were reflected by a mirror and split into three beams of light, each passing through another lens and a colour filter–blue, red or green–on to the sensitive plate.

The first colour screen processes, based upon du Hauron's suggestion of 1869, were those of the Dublin physicist CHARLES JASPER JOLY (1896) and of JAMES W. MCDONOUGH of Chicago (1897). Joly had patented in 1895 the first line screen by a ruling method, with 200 lines to an inch, whereas that of McDonough with 300–400 lines was finer. In both processes the taking screen–a sheet of glass ruled with alternate lines of red, green and blue-violet–was placed in front of an orthochromatic plate during exposure. After development, a diapositive was made of this line negative and bound up with a viewing screen, care being taken that the lines of the latter were in proper register with the lines of the former. As with all screen processes, the screen absorbed a good deal of light, and neither Joly's nor McDonough's process found much practical application. McDonough also patented in 1892 a dusting-on method with fine particles of coloured glass, transparent pigments, gelatine or resin suitably dyed. The whole screen was subsequently to be coated with photographic emulsion. This system was used in the Autochrome plate.

The 'Autochrome' process of the brothers AUGUSTE and LOUIS LUMIÈRE was the first to achieve a fair degree of popularity, particularly with amateurs. Though this colour-screen process had been patented in 1904, the 'Autochrome' plates manufactured at the Lumières' factory at Lyons were not commercially introduced until 1907, after good panchromatic emulsion was available. The glass plates were coated with microscopically small grains of potato-starch dyed green, red and blue. Over them a thin film of panchromatic emulsion was applied. The exposure was made through the glass side of the plate, i.e. through the dyed starch grains acting as colour filters. After development the plate was re-exposed to light and redeveloped (reversal process), resulting in a transparency composed of small specks of primary colours giving the effect of mixed colours, as in a *pointilliste* painting. 'Autochrome' plates were manufactured in all standard sizes, but the pleasure of seeing a picture in colour was fraught with certain disadvantages: the exposure was about forty times longer than with black and white, and the transparancies were rather dark, due to the starch grain screen.

Other colour processes. Brief mention must still be made of a few of the best-known of the other colour processes invented before the end of the First World War. All were variations of previous additive or subtractive processes, and like them, too complicated and expensive to find widespread application.

Among the *additive* processes neither CLARE L. FINLAY's 'Thames' (1908) and 'Paget' plates (1913) nor LOUIS D. DUFAY's screen plate process (1910) were any improvement on Lumière's Autochrome, and the Agfa colour plate (1916) being introduced in the middle of the war stood no chance of being tested until marketed in film form as 'Agfacolor' ten years later.

Subtractive processes: with the Sanger-Shepherd method (1900) either transparencies or prints on paper could be produced. In the former the three separation negatives were printed on celluloid coated with bichromated gelatine containing a little silver bromide. After developing and fixing, the sheets were dyed in the complementary colours to those of the taking filters, and superimposed. For paper prints, the dyed gelatine sheets were transferred to paper. The 'Pinatype' invented by LÉON DIDIER and introduced by Dr Ernst König (1905) met with little interest, whilst the 'Uvachrome' process introduced by DR ARTHUR TRAUBE in 1916 was commercially practised by the company founded by him in Munich in 1918 until the premises were destroyed during the Second World War. It was similar to Sanger-Shepherd's method.

Photography in Natural Colours. It is obvious that a directly produced natural-colour photograph without the intervention of filters or dyes, which can only give close approximations, would be preferable, if a practical process could be devised. The search for one occupied the minds of a number of nineteenth-century experimenters for many decades, but when eventually one was announced in 1891 and hailed by the scientific world as a great triumph, it proved far too complicated and uncertain to find any practical application.

All the natural-colour processes were based on an observation of the German physicist JOHANN SEEBECK in 1810 that silver chloride retains the spectrum colours to a degree. Goethe published Seebeck's communication to him in his *Farbenlehre* (1810). After the introduction of photography, SIR JOHN HERSCHEL once more drew attention to this curious property of silver chloride.[6] He did not, however, succeed in fixing the colours, which could only be examined by diffused daylight or lamplight.

EDMOND BECQUEREL laid the foundation of heliochromy with his researches which began in 1848 with the spectrum on a sensitized daguerreotype plate, and continued on and off until 1855. But finally he had to admit that all attempts to fix the colours permanently were fruitless–and that after an exposure of 10–12 hours in the camera! Details of his researches will be found in his communication to the Académie des Sciences on 18 December 1857.[7]

ABEL NIÉPCE DE SAINT-VICTOR carried out experiments similar to Becquerel's between 1851 and 1866.[8] In 1867 he showed at the Paris Universal Exhibition a number of heliochromes which proved that he had come nearer to solving the problem of fixing the colours than Becquerel had, but even Niépce de Saint-Victor's heliochromes (mostly of a doll) only lasted three to four days, and the pictures in the exhibition had to be changed very frequently.

In heliochromy a daguerreotype plate, preferably of pure silver, not silver-plated copper, was dipped in a weak solution of copper- and iron chloride. This gave the plate a bright pink hue. It was then covered with a solution of dextrine saturated with lead chloride, dried and heated. After three to four hours' exposure in the camera the plate was again heated to preserve the colours. Vivid, true colours were obtained, but there remained the insuperable drawback of their impermanence. Eder stated that one of Niépce de Saint-Victor's heliochromes in his possession had retained its colours after forty-years–but a picture that has to be kept in the dark is not much use.

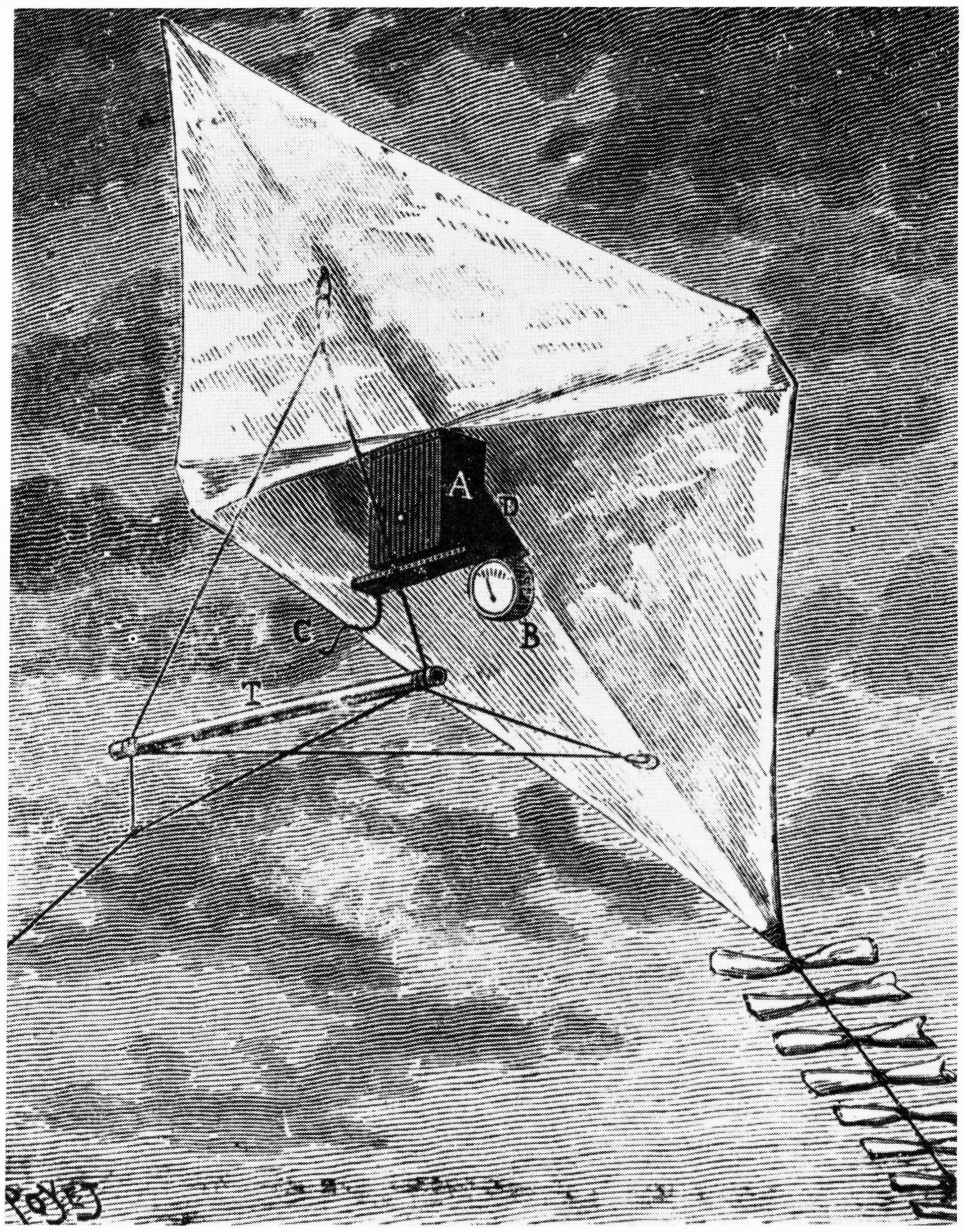
About the time Niépce de Saint-Victor published his first announcement of 'Héliochromie' in 1851, an American clergyman, the REV. LEVI L. HILL of Westkill, N.Y., claimed to be able to produce daguerreotypes in colour. The startling announcement almost brought professional portraiture in America to a standstill for some months. Hill collected subscriptions for a manual, while perfecting his alleged process, but no one ever saw a 'Hillotype', and the name is the unpleasant reminder of a gigantic hoax.

ALPHONSE POITEVIN's method for obtaining colours on paper coated with silver chloride[9] was, like Becquerel's, only of theoretical interest.

The interference process of GABRIEL LIPPMANN, professor of physics at the Sorbonne, was based on the interference of light-waves, and aroused much scientific speculation in 1891.[10] The phenomenon of colours produced by interference was known to Sir Isaac Newton and can be seen in 'Newton rings', soap-bubbles, mother-of-pearl, oil on a wet road, all of which appear coloured (mainly magenta and peacock colour) though consisting of colourless substances. In the Lippmann process a thin photographic plate coated with fine-grain silver bromide was placed in the camera with the emulsion side away from the lens in contact with mercury. This forms a mirror-like surface which reflects the light-waves back upon themselves, causing stationary or standing waves which leave their impression in the emulsion, so that the direct positive picture reflects back light-rays in the same wave-lengths (colours). The picture could best be seen by viewing it in parallel light and holding the plate at a certain angle. By transmitted light it gave the appearance of a dense negative. Exposures were very long, 2–3 hours; the picture was not only difficult to see, but impossible to reproduce, and the process too uncertain of success to have any future.

Lastly, we have briefly to refer to the possibility of obtaining direct colour photographs by diffraction, a process patented by PROFESSOR R. W. WOOD of Wisconsin in March 1899. To view these small pictures ($3\frac{1}{4}$ in. × $3\frac{1}{4}$ in.) Ives designed the Diffraction Chromoscope in 1900. The first part of Wood's colour process, i.e. the taking of the three separations and making diapositives from them, was the same as for Kromograms. Then each diapositive has superimposed on it a diffraction screen: 2,000 lines per inch for red, 2,400 for green, 2,750 for blue. The three diapositives are then bound together in register to form the final picture, which looks perfectly transparent, and merely consists of a diffraction screen with variable spacing. When the transparency is viewed in the Diffraction Chromoscope light of different wavelengths passes through the corresponding lines to form a perfect colour picture. This process, too, found no practical application, and apart from the prototype instrument and pictures in the Gernsheim Collection, which formerly belonged to Wood, we doubt that there are any others still in existence.

Plates 309–322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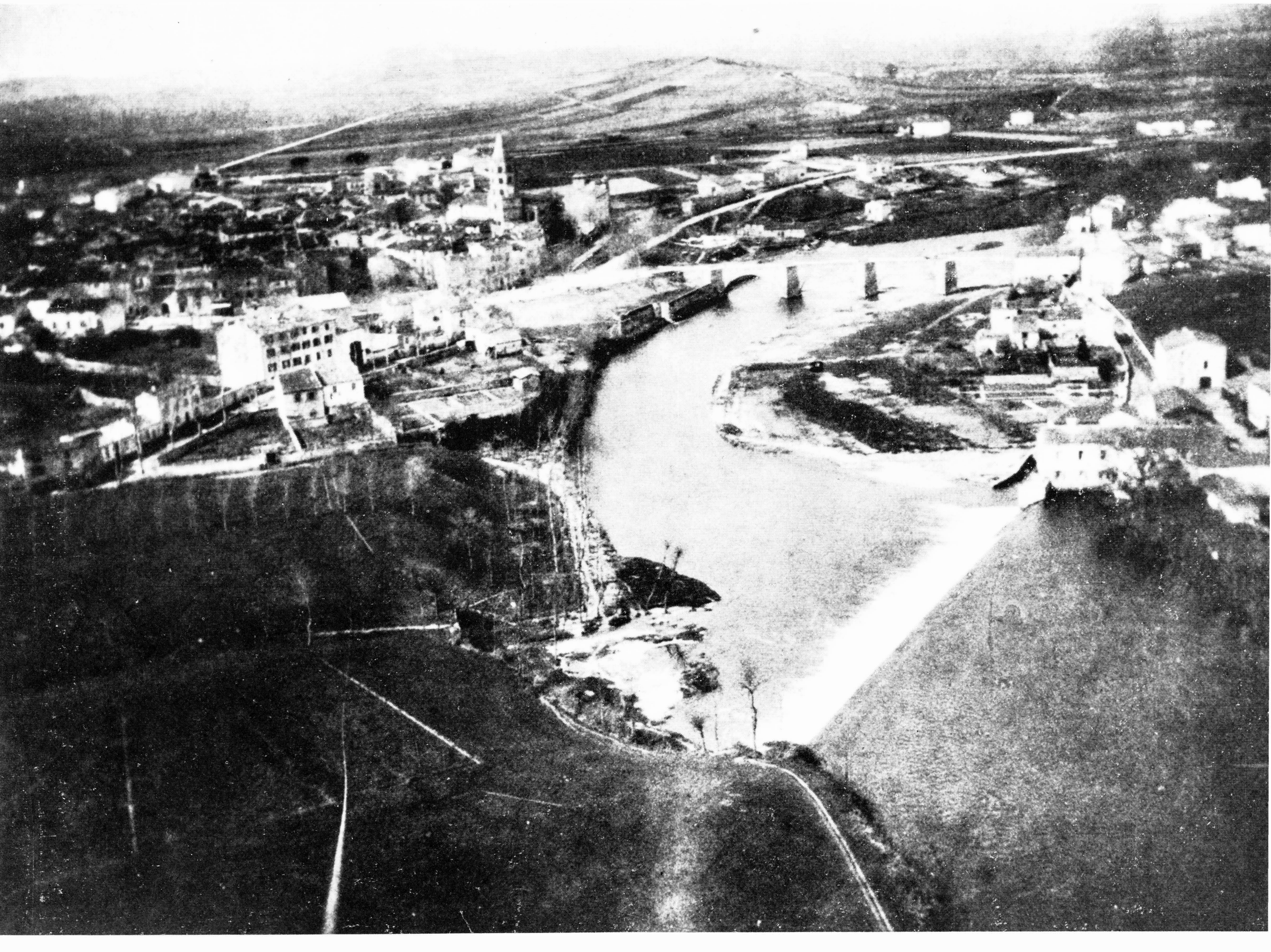
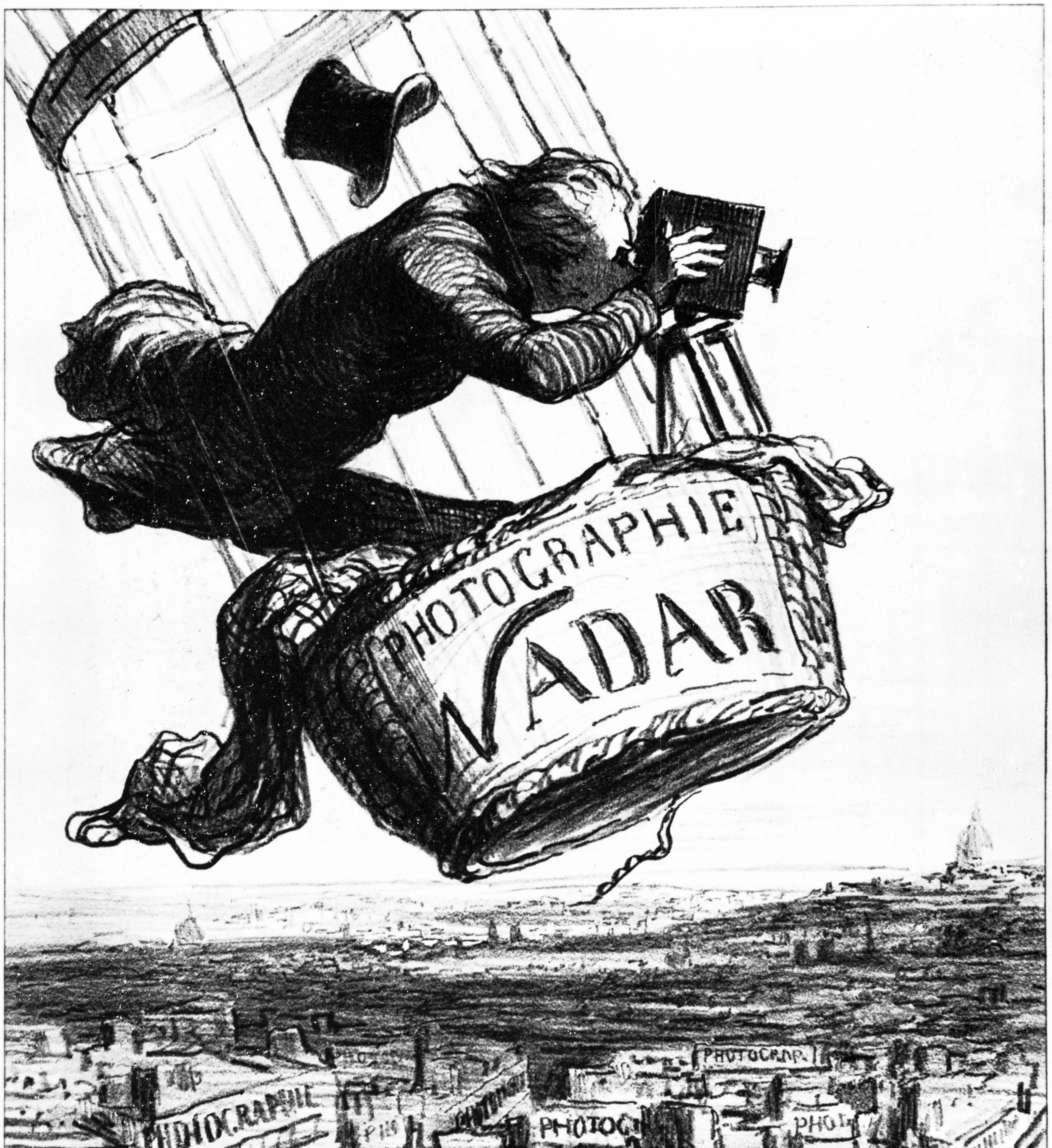
309 ARTHUR BATUT's arrangement for kite photography

310 ARTHUR BATUT. Kite photograph of Labruguière, 1889

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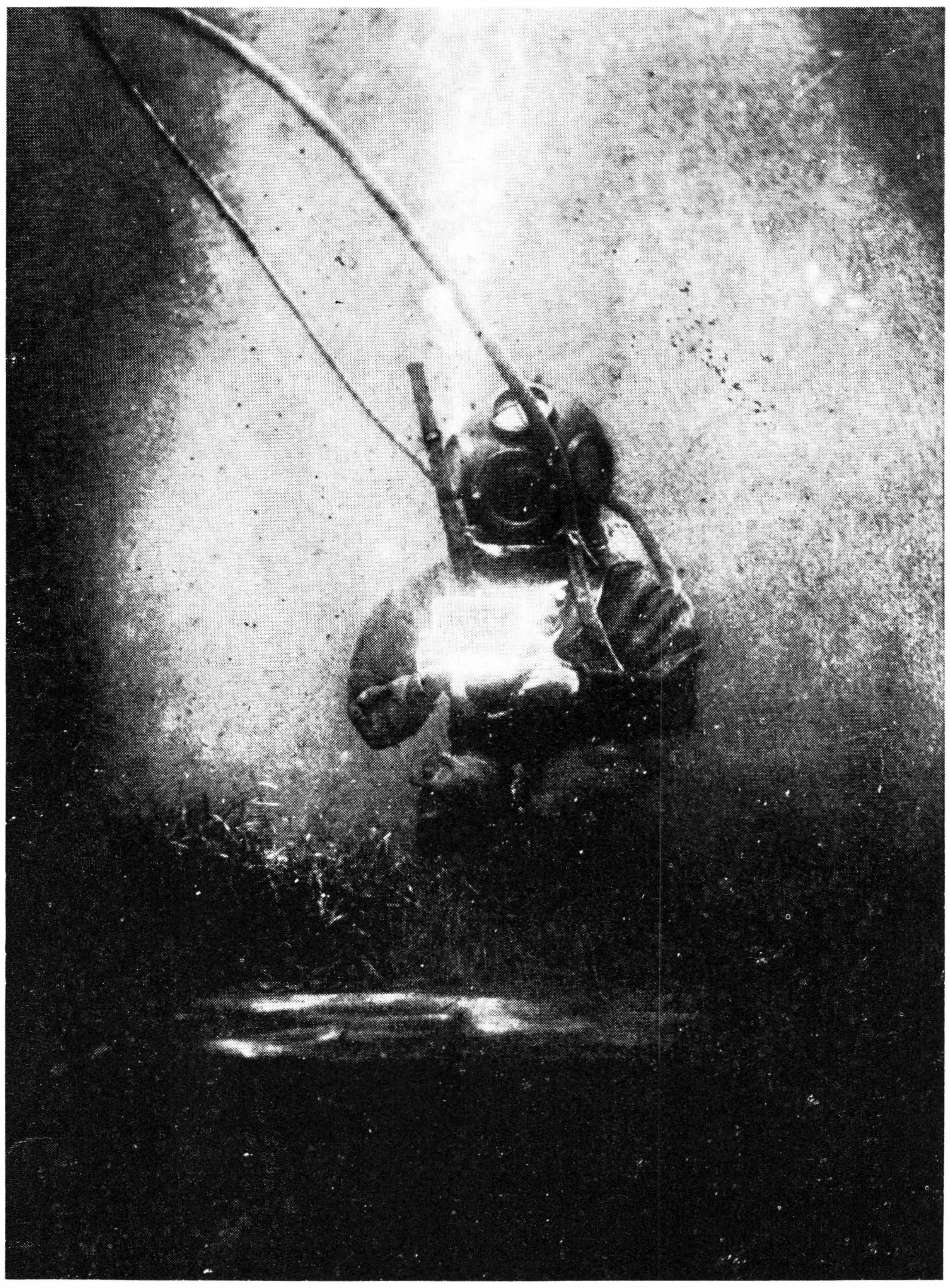
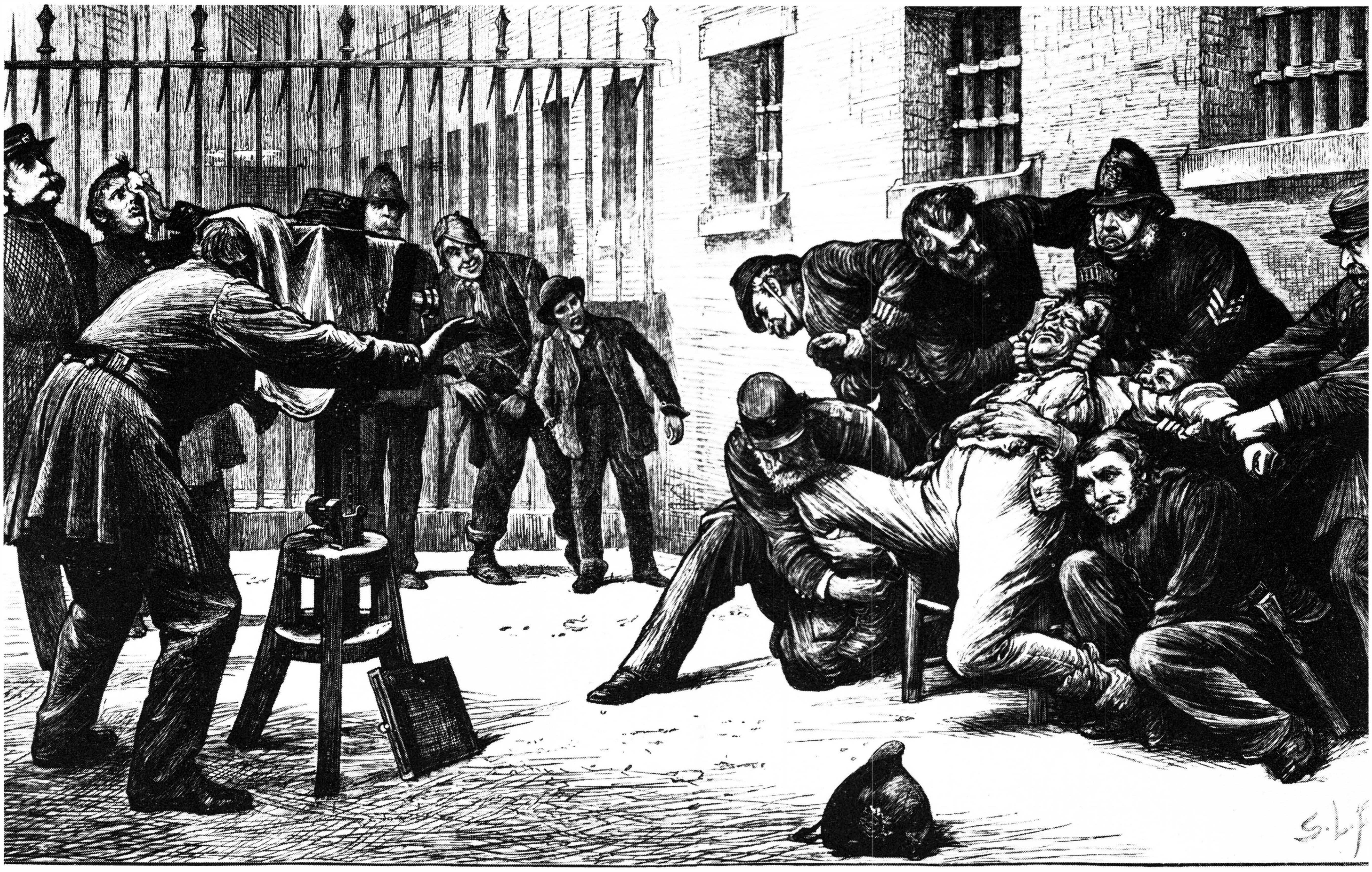
311 HONORÉ DAUMIER. 'Nadar élevant la Photographie à la Hauteur de l'Art.' Proof print of a lithograph published in *Le Boulevard*, May 1862

312 NADAR. View of Paris from a balloon. Stereoscopic photograph, 1862

313 The first successful under-water photograph, showing the experimenter Louis Boutan, 1893

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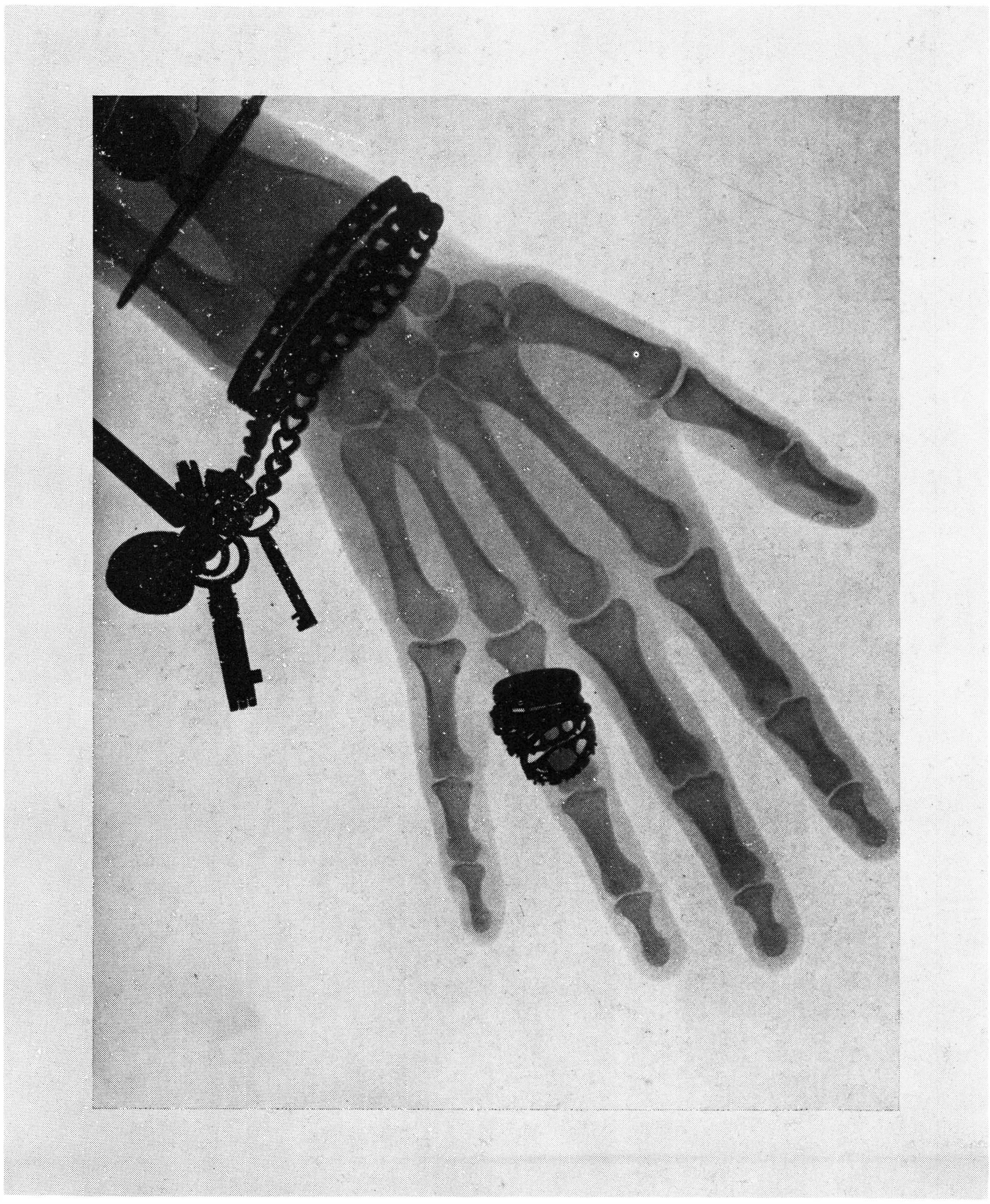
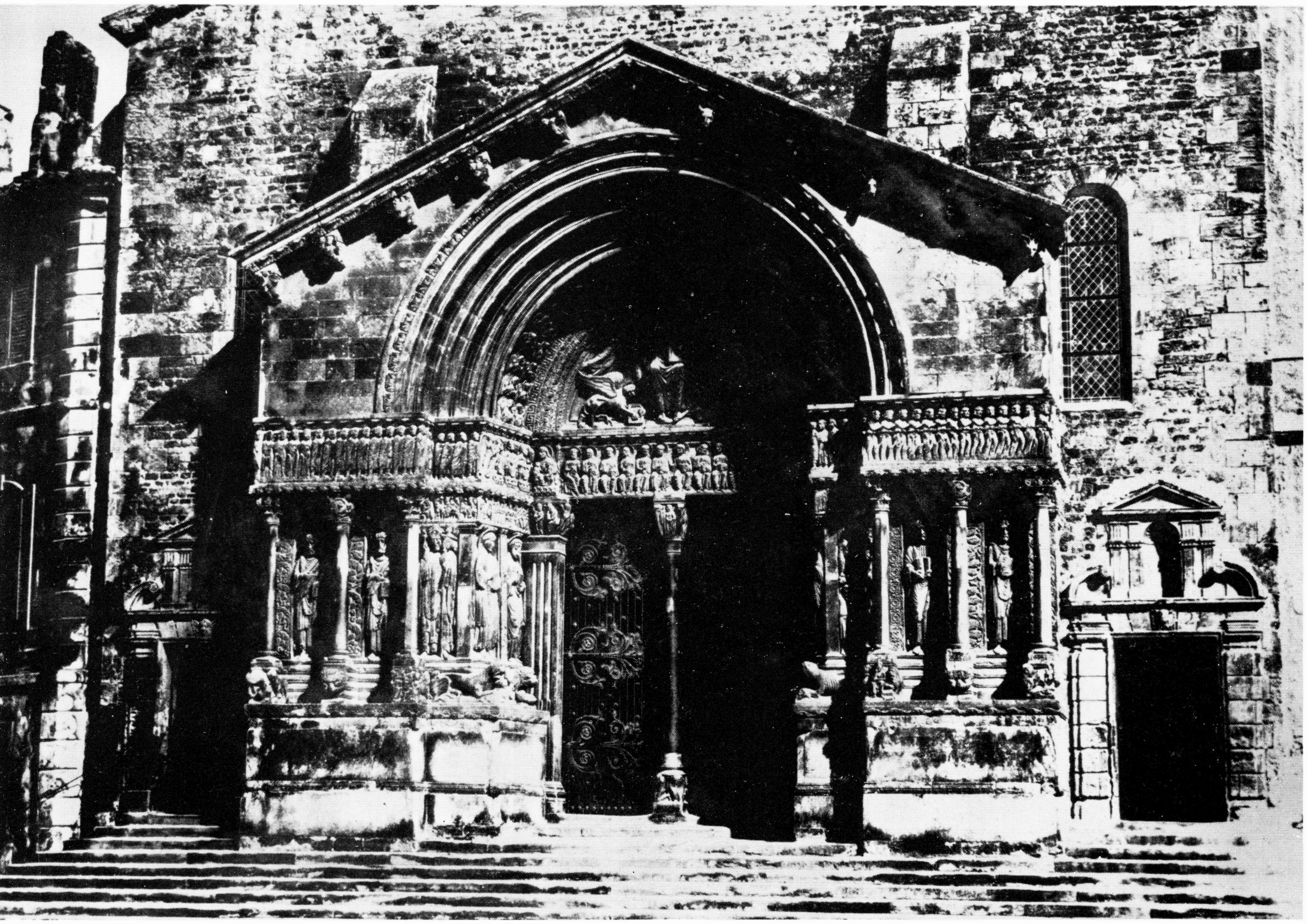


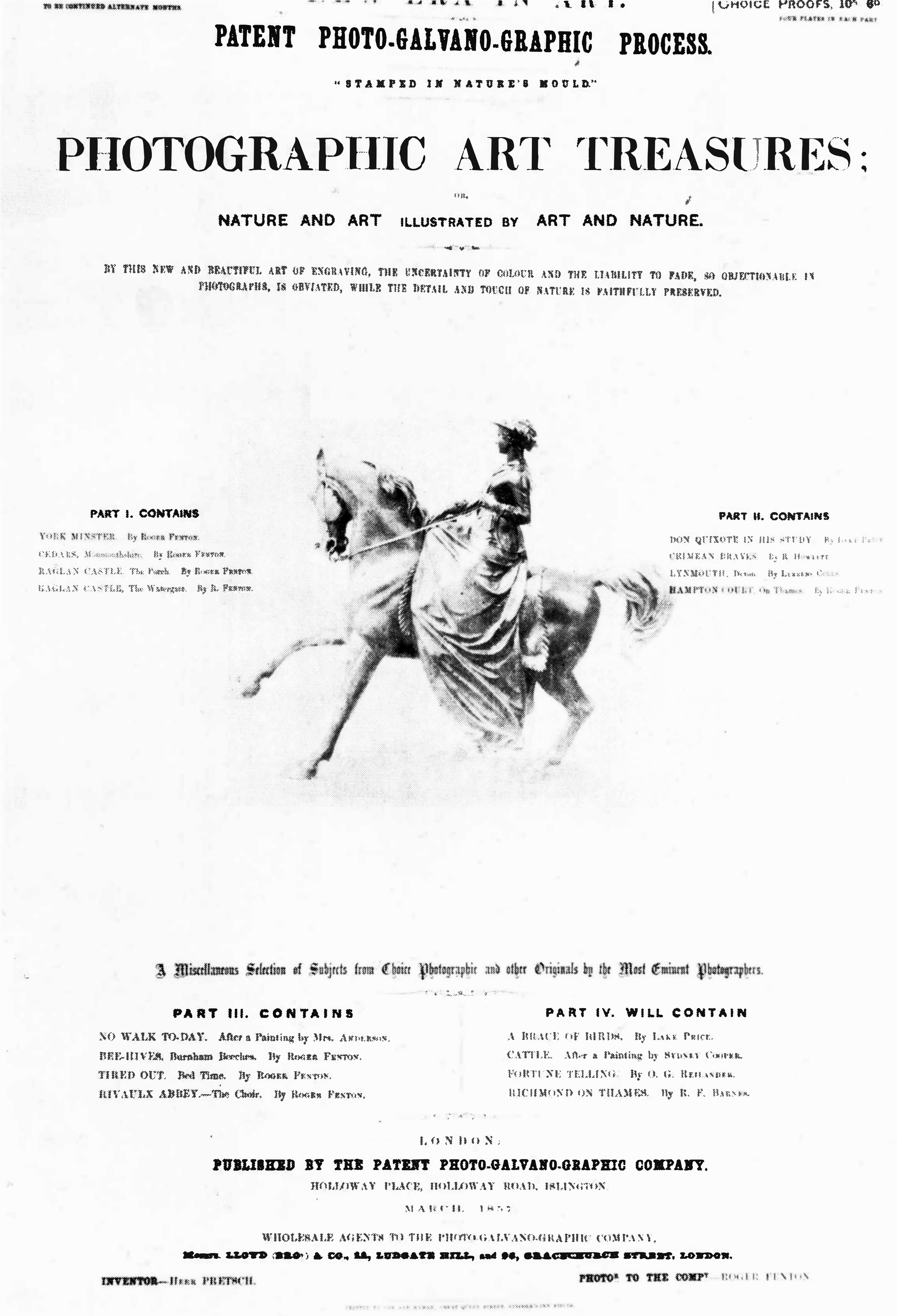
314 An unwilling sitter for a police record. Woodcut by Sir Luke Fildes in *The Graphic*, 1873

315 Early English X-ray photograph, *c.* 1896/7

316 H. FIZEAU. Proof print from an etched daguerreotype, 1842

317 FOX TALBOT. Portal of St Trophime, Arles. Photoglyphic engraving, 1866





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PART I. CONTAINS

YORK MINSTER. By Roger Fenton.
CEDARS, Monmouthshire. By Roger Fenton.
RAGLAN CASTLE. The Porch. By Roger Fenton.
RAGLAN CASTLE, The Watergate. By R. Fenton.

PART II. CONTAINS

DON QUIXOTE IN HIS STUDY. By Lake Price.
CRIMEAN BRAVES. By R. Howlett.
LYNMOUTH, Devon. By [illegible]
HAMPTON COURT, On Thames. By Roger Fenton.

A Miscellaneous Selection of Subjects from Choice Photographic and other Originals by the Most Eminent Photographers.

PART III. CONTAINS

NO WALK TO-DAY. After a Painting by Mrs. Anderson.
BEE-HIVES, Burnham Beeches. By Roger Fenton.
TIRED OUT. Bed Time. By Roger Fenton.
RIVAULX ABBEY.—The Choir. By Roger Fenton.

PART IV. WILL CONTAIN

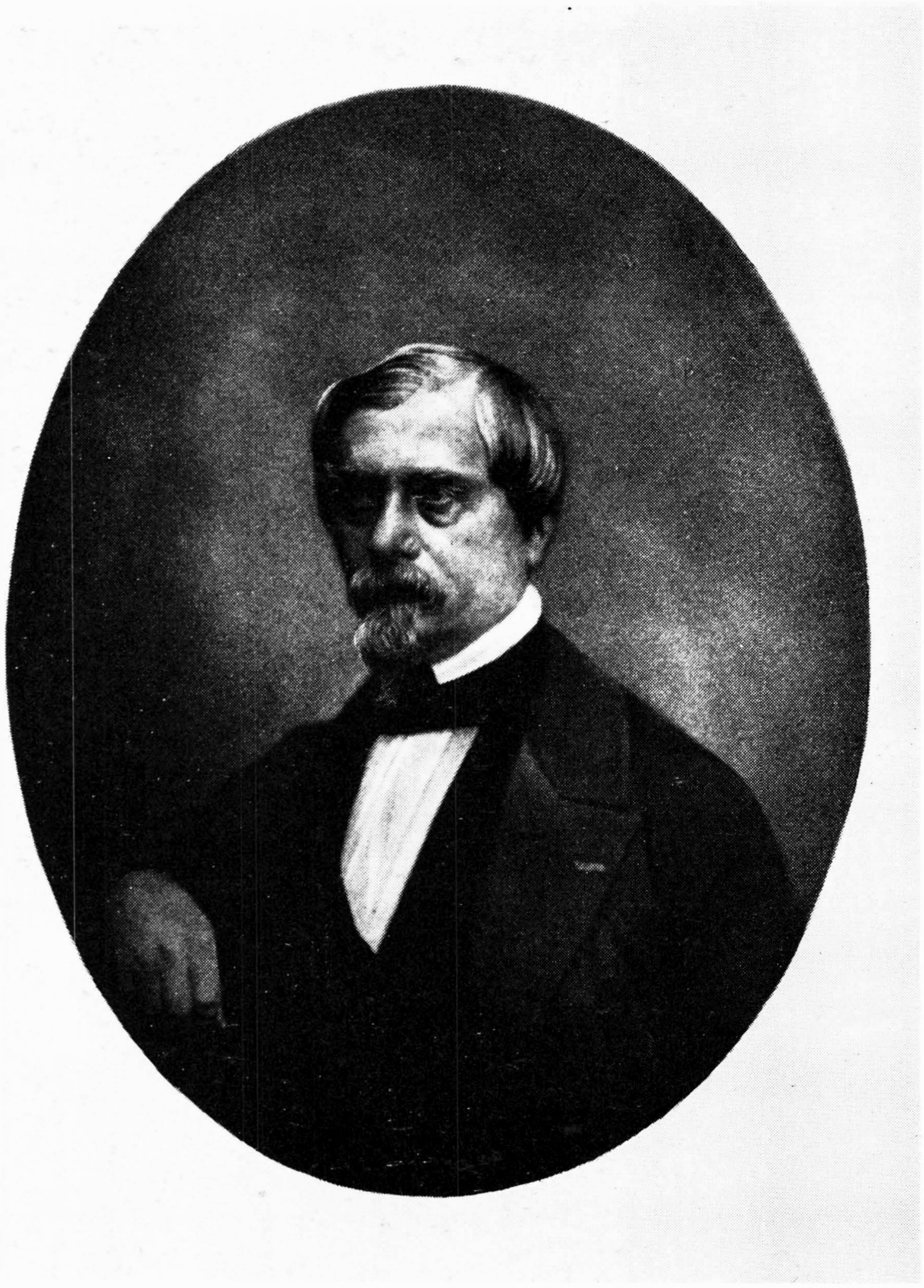
A BRACE OF BIRDS. By Lake Price.
CATTLE. After a Painting by Sydney Cooper.
FORTUNE TELLING. By O. G. Rejlander.
RICHMOND ON THAMES. By R. F. Barnes.

LONDON:
PUBLISHED BY THE PATENT PHOTO-GALVANO-GRAPHIC COMPANY.
HOLLOWAY PLACE, HOLLOWAY ROAD, ISLINGTON.
MARCH, 1857.

WHOLESALE AGENTS TO THE PHOTO-GALVANO-GRAPHIC COMPANY,
Messrs. LLOYD (BROs) & CO., 22, LUDGATE HILL, and 96, GRACECHURCH STREET, LONDON.

INVENTOR—Herr PRETSCH.

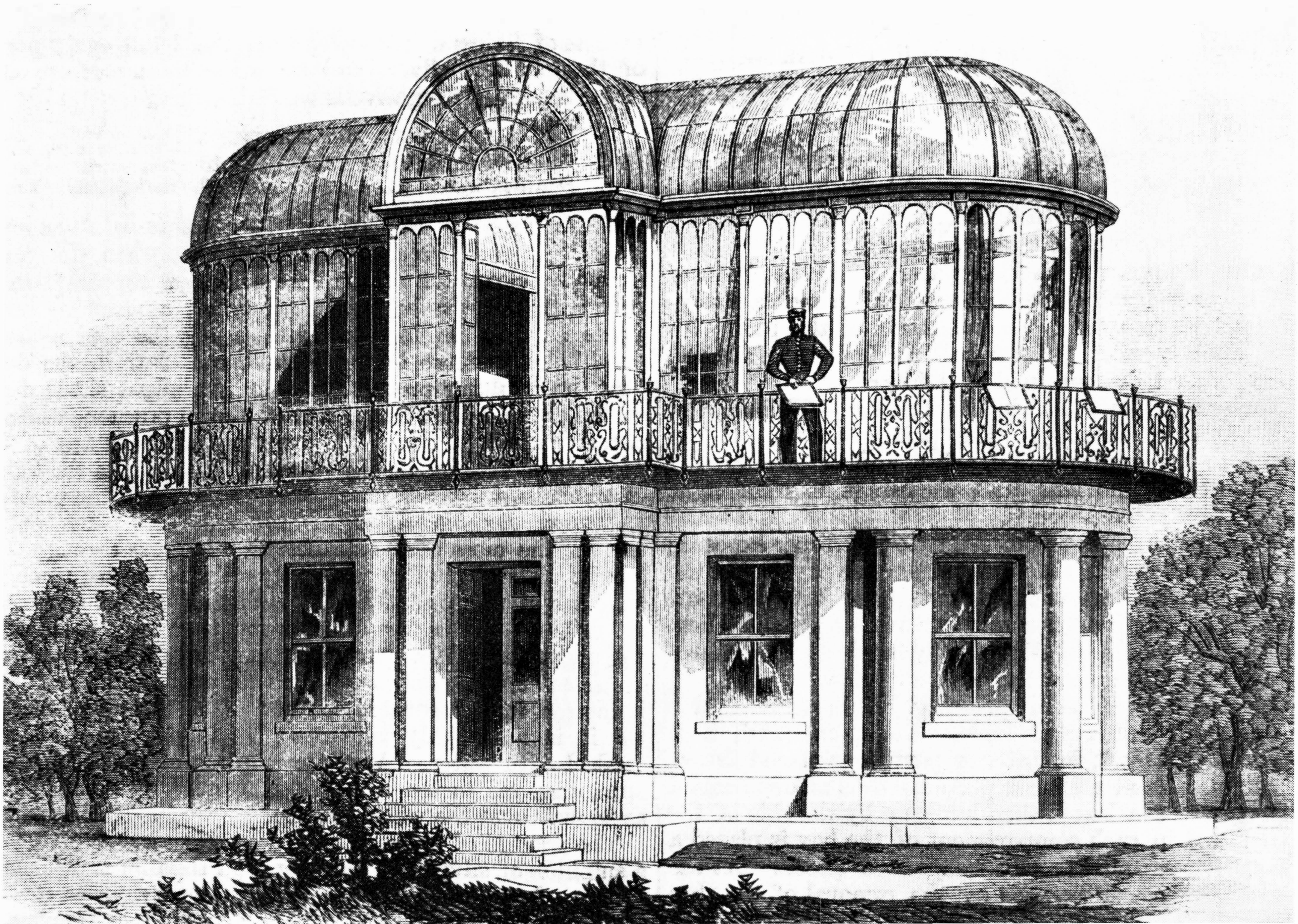
PHOTOs TO THE COMPY—ROGER FENTON.

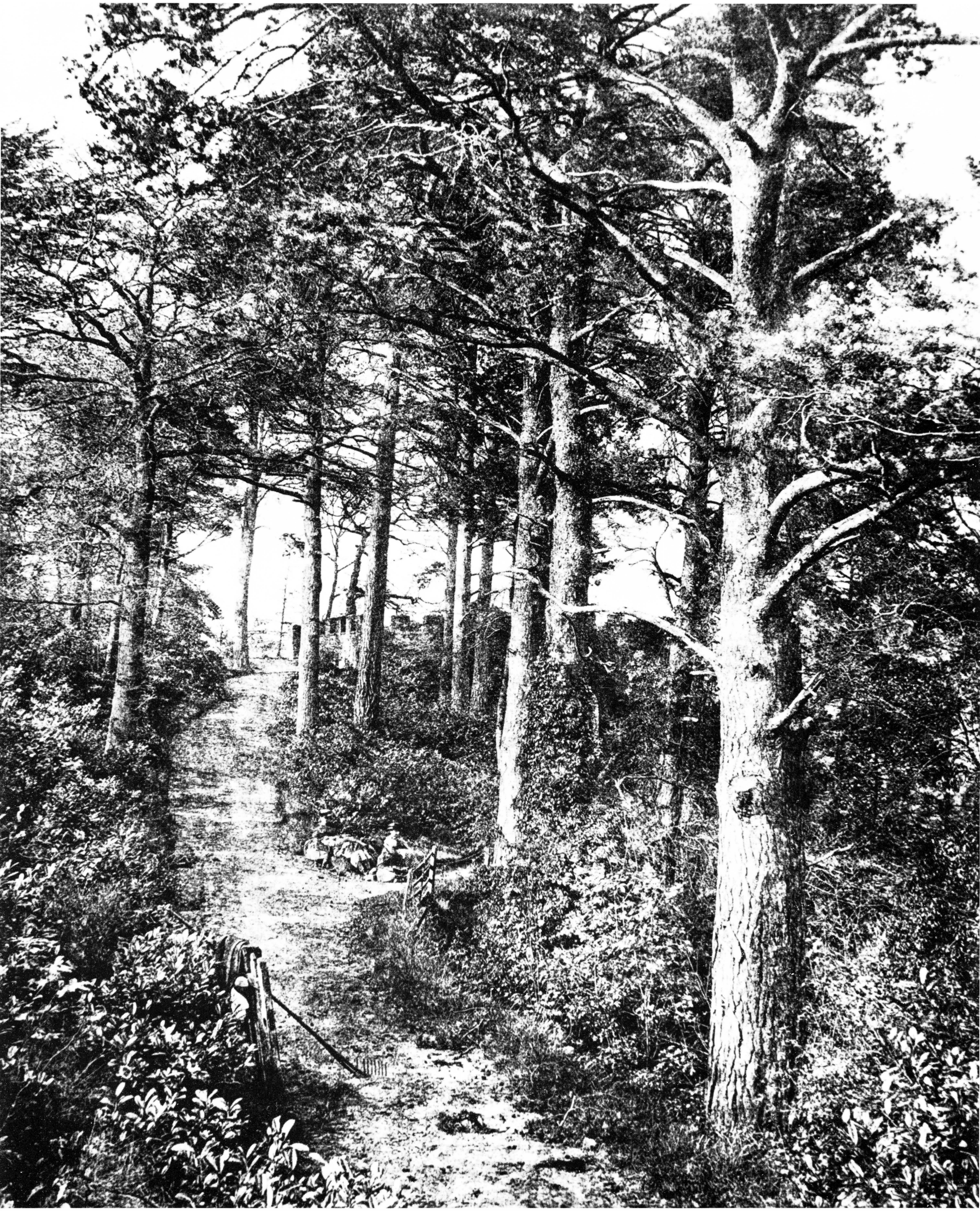


318 Cover of *Photographic Art Treasures*, 1857

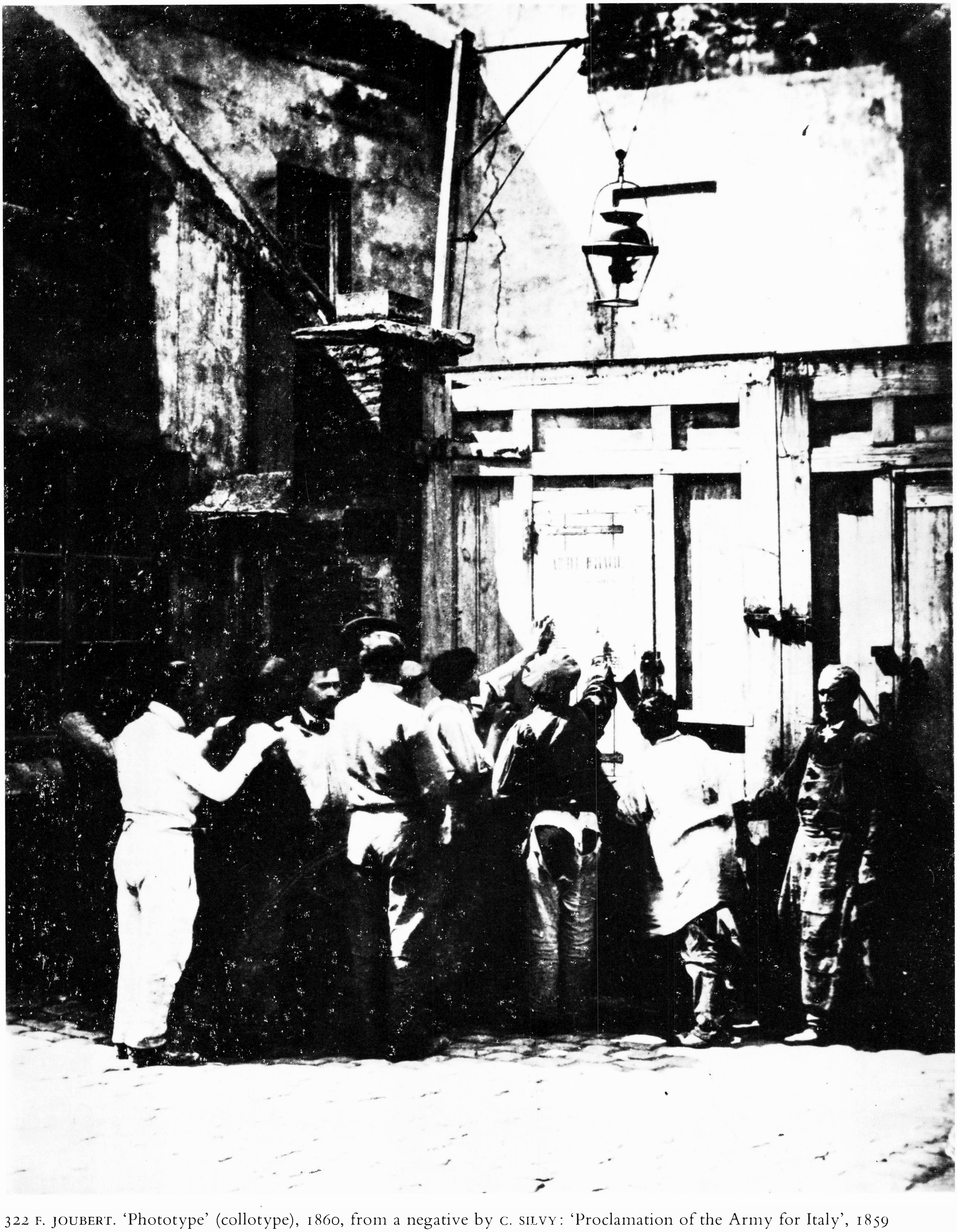
319 ABEL NIÉPCE DE SAINT-VICTOR. Heliogravure by A. RIFFAUT, 1856

320 Photographic studio of the Ordnance Survey Department, Southampton, 1860





321 E. & J. BULLOCK. Woodland scene, photolithograph, 1866. From a photograph by Major Gresley



322 F. JOUBERT. 'Phototype' (collotype), 1860, from a negative by C. SILVY: 'Proclamation of the Army for Italy', 1859

Part VIII

PHOTOGRAPHY AND THE PRINTED PAGE

44 *Photomechanical printing processes*

The term 'photomechanical' denotes processes in which, by the action of light upon chemical substances, a printing surface is prepared from which a large number of impressions can be made on a printing press. The first general treatise on the various applications of photography to the printing press was published by Georg Kessler in Berlin in 1856.[1]

The following is a résumé of the more important inventions from which modern book and newspaper illustration evolved. They may be divided into three groups.

1. Processes in which the picture is *below* the surface of the plate (intaglio). In these the printing ink is first applied generally to the surface, then rubbed off the elevations, and the remainder afterwards extracted from the depressions by the paper, forming an image dark in proportion to the depth of the depressions.
2. Processes in which the picture is *on* the surface of the plate, which bears a coating capable of taking up greasy ink, or repelling it, according to the amount of light it has received.
3. Processes in which the picture is raised *above* the surface of the plate–a type block in which the elevations receive the ink, half-tone being produced by a system of dots.

The great difficulty in all early photomechanical printing was the reproduction of the smooth transitions between shadows and highlights in a photograph.

I PHOTO-ENGRAVING

The earliest method of photo-engraving, apart from Niépce's (see chapter 5), was the etching of daguerreotypes. The first to announce success was **DR ALFRED DONNÉ**, head of the Charité Clinic in Paris. On 23 September 1839 he laid before the Académie des Sciences an etched daguerreotype plate and paper proofs from it. On 15 June following, he revealed the process,[2] consisting in etching an ordinary daguerreotype plate with nitric acid, which attacked only the bare silver parts, resulting in a weak engraving plate from which forty prints could be pulled.

DR JOSEPH BERRES, professor of anatomy in Vienna, stated in the *Wiener Zeitung* on 18 April 1840 that he had succeeded in converting daguerreotypes into printing plates. In a paper[3] before the Imperial Society of Viennese Doctors, Berres disclosed that he etched with nitric acid daguerreotypes taken on solid silver plates–ordinary silver-plated copper would not do–and that as many as 200 impressions could be obtained.[4] He published his process in a brochure entitled *Phototyp nach der Erfindung* *des Prof. Berres in Wien* (1840) which was illustrated with five plates (in an edition of 200), the first publication with photomechanically produced illustrations.

On 1 March 1841 François Arago announced[5] that the physicist HIPPOLYTE FIZEAU had made facsimile printing plates of daguerreotypes by electrotyping. The following year Fizeau succeeded in etching daguerreotype plates deeper than Berres had done by depositing chloride of gold on the high lights, which enabled the plate to bear repeated etching in the dark parts (the bare silver). By protecting the printing plate by electrotyping it with copper he was able to pull at least ten times as many impressions as Berres, for when the copper deposit had worn off, the plate could be electrotyped again. Fizeau obtained good half-tone, supplemented by aquatint grain when Pl 316 necessary. Two excellent photo-etchings by his process were included in vol. 2 of *Excursions daguériennes: vues et monuments les plus remarquables du globe*, published by N. P. Lerebours, Paris, 1842.[6] Fizeau's was the most successful of these etching methods, and in its final form was patented in England by A. Claudet in November 1843.

(SIR) W. R. GROVE, F.R.S., etched the daguerreotype plate with hydrochloric acid, but finding that if etched deeply the finer lines were lost, while if etched to make an exact impression the plate was spoiled immediately during its cleaning by the printer, he made facsimile copies of the etched daguerreotype by the electrotype process. He submitted a paper on the subject, with specimens, to the London Electrical Society on 17 August 1841.[7]

While the purpose underlying the etching of daguerreotypes was to find a means for the cheap multiplication of a unique picture, and of applying the light-drawn image to book illustration, FOX TALBOT's attempts were prompted by totally different motives. His calotype pictures could be multiplied *ad infinitum* and used for book illustration, but he was chagrined at the fading of silver prints. So he set out to make permanent pictures in printing ink. Having studied Fizeau's etching method, he had made (about 1850) by an engraver named G. Barclay, an ordinary engraved copperplate of one of his own photographs of Melrose Abbey and endeavoured to produce the same result by photographic means.[8] Eventually Talbot evolved a method which he patented on 29 October 1852. Six months later the details of Photoglyphy (Greek γλύφειν, to engrave) were revealed.[9]

Photoglyphy. Talbot coated a steel plate with bichromated gelatine, impressed on it the image of a piece of black gauze folded so that the threads crossed at an angle of 45°, and then exposed it under a transparent positive photograph, or a superimposed object such as lace or ferns. After washing out the unexposed chromic salts he etched the plate. The expedient of breaking up the image into minute dots of light and dark by first exposing the plate to the cross-lines of the gauze in an endeavour to hold the ink and obtain half-tones was correct in theory, but he failed to achieve the desired goal. Talbot also threw out the suggestion of interposing a glass plate covered with fine lines–the principle of the modern half-tone screen–a technique that became of fundamental importance in most photomechanical printing processes.

The reproduction of the half-tone which renders photographs so pleasing eluded Talbot until 1858 when on 21 April he patented for photo-engraving the method employed in aquatint engraving: covering the bichromated gelatine (after exposure) with powdered resin and melting it to form grain. The plate was etched with solutions of perchloride of iron of varying strength which penetrated the gelatine in proportion to the extent to which light had acted upon it. The application of powdered resin ('aquatint grain') was not a novelty, however. Not only had Talbot himself referred to this possibility in his first engraving process[10] but it had already been adopted by Niépce de Saint-Victor and Lemaître in their heliogravure[11] and been published in France and England.

Immediately after the patent was sealed, on 22 October 1858, Talbot published details of his new photoglyphic engraving in *The Photographic News*, and with each copy of the issue of 12 November he presented one small photoglyph–seven different subjects in all, engraved from views by the Parisian photographers Soulier & Clouzard. In September of the following year he presented another and larger photoglyph, of the Tuileries.

None of these photoglyphs of 1858–9 was superior to Fizeau's etched daguerreotypes of sixteen years earlier, and, like them, they were produced entirely by chemical action without any retouching by an engraver. Talbot's last work in this field, three plates produced in July 1866, showing the portal of St Trophime, Arles, the church of St Maurice at Vienne, and a view of Avignon, can be said to come close to the ultimate goal, though still lacking detail in the shadows. Talbot claimed that at least 5,000 prints could be pulled from the plate before it began to show any sign of deterioration.[12] Pl 317

In the interval between Talbot's two patents a number of people entered the same field of research. One of them was PAUL PRETSCH, Manager of the Imperial Printing Establishment in Vienna, who in 1854 evolved an electro-engraving process which he called Photogalvanography (English patent, 9 Nov. 1854).

Photogalvanography. A glass plate was coated with gelatine or glue containing bichromate of potassium and iodide of silver (the function of the silver salt being only to roughen the sensitive coating to make it hold ink) and exposed beneath a diapositive for several hours. When washed with cold water the image appeared in relief. In the highlights the hardened gelatine remained unaltered, but in the parts sheltered from light by the shadows of the diapositive, the bichromate was washed out and the gelatine swelled up in proportion to the half-tone of the diapositive, and, on drying, reticulated. From this relief picture an intaglio mould was made in gutta-percha and electrotyped with copper, the copper plate or matrix thus obtained exactly resembling the raised gelatine picture. The thick intaglio copper-plate from which the proof was to be printed was obtained by the electrotype process from the matrix. The preparation of the plate took about six weeks. Four hundred to five hundred good impressions could be struck from the plate, and a considerable number of plates could of course be obtained from the matrix.[13] This was the method as practised in 1856, and an improvement on that patented, in which a *sunk* picture was obtained by washing out the unaltered gelatine resulting in an intaglio matrix and finally a raised printing plate. The notion of *raised* relief pictures depending on the *swelling* of the gelatine (for producing an intaglio printing plate) was probably due to Poitevin, who had meanwhile published this discovery in his patent of 1855.

Pretsch, who had come to England to exploit his invention, was not ready until the beginning of 1856 to form a company, and another ten months passed before the first plates were issued. When at last there appeared in November the first number of *Photographic Art Treasures, or Nature and Art illustrated by Art and Nature*, everyone who who saw it was 'perfectly crazy with astonishment and delight',[14] for this first publication of photographs in printing ink marked the dawn of a new epoch in the history of photography and printing–photo-engraving.

The advantage of photo-engraving over hand-engraving as regards accuracy hardly needs stressing, but the advantages of cheapness and speed may be less obvious. Whereas the Photogalvanographic Company required six weeks to make a printing plate (subsequent photo-engraving processes were greatly speeded up), the work of engraving paintings took several years. Frith's 'Railway Station' occupied the engravers for four years, and Raphael Morghen needed six years to engrave Raphael's 'Transfiguration'. Consequently the cost of good engraving-plates ranged from several hundred to several thousand pounds, according to the repute of the engraver and the time taken over the work. A Paris printseller paid as much as 3,000 guineas to have Paul Delaroche's 'Execution of Lady Jane Grey' engraved,[15] and prints from hand-engraved plates had to be priced at several guineas, whereas prints from photo-engraved plates could be sold for a shilling or so.

Pl 318 Altogether six parts of *Photographic Art Treasures* appeared at irregular intervals until September 1857 in the unusually large format $15\frac{1}{2}$ in. × 23 in. Each part contained four plates from popular photographs by well-known photographers such as Fenton, Lake Price, and Rejlander, and reproductions of paintings. The prints were issued in three qualities: choice proofs, proofs, and prints, the prices for the parts varying between 10*s.* 6*d.* and 5*s.*[16]

The firm also issued a series of views of Bolton Abbey by Roger Fenton, manager of the photographic department and chief photographer to the company. The average picture area was 11 in. × 15 in. and in this case too there were three editions of different qualities costing between 3 and 7 guineas. In addition a large number of single plates of miscellaneous subjects were published from time to time.

Unfortunately, Photogalvanography was not yet in a sufficiently perfect state to render it independent of costly retouching at the hands of the engraver, and the firm went out of business after about two years. For a time the inventor carried on in collaboration with the London printers and stationers De La Rue, issuing pictures from nature 'printed by the ordinary letterpress, from a block produced by means of photography and electrotype' and claimed to be 'absolutely untouched by the graver'. In this variation of Photogalvanography the pictures were transferred to lithographic stone.[17]

During his nine years' residence in England Pretsch had to contend with so many difficulties and annoyances that he was a sick man when he returned to Vienna in 1863. Fox Talbot twice appeared on the field as a belligerent. In 1857 he threatened legal action for an alleged infringement of his 1852 patent[18] (which included the use of gelatine and bichromate of potash as the sensitive agent). Two years later, when Pretsch was working the lithographic application of his process, Talbot claimed that this too was an infringement of his 1852 patent (in which he mentioned that the engraving process for metal plates could also be applied to lithographic stone). The editor of *The Liverpool & Manchester Photographic Journal*, in an eulogy on the economy of Pretsch's latest process, with which, by the multiplication of electrotypes and transfers to several lithographic stones, it was estimated that 100,000 copies could be produced from one photograph, announced that he would present readers with a specimen. Talbot argued that by carrying out this intention without first obtaining his sanction, the journal would be infringing his patent. Anxious to avoid legal squabbles, 'not knowing in what particular manner the alleged infringement would occur', the editor thought it wise to obtain Talbot's permission.[19]

In this fashion Talbot tried to take credit for almost every advance in photography made in England. Several years earlier, photographers had been obliged to obtain a licence from him to work Archer's collodion process; now we find an editor making humiliating concessions in order to be able to illustrate another man's invention. Talbot had altogether wrong notions about patenting: he patented abstract ideas, whereas only practical methods of making or doing things can be protected. He assumed that no one after him had the right to patent another way of achieving the same result, and by various means he succeeded for many years in controlling in England all methods of making pictures by light, except the daguerreotype. He now aimed to control all photo-engraving processes depending on the light-sensitivity of bichromate of potash and organic substances, and this in spite of Mungo Ponton's and Becquerel's fundamental observations, without which he could not himself have succeeded. Jabez Hogg complained[20] that he was prevented from illustrating his book on the microscope with photo-engravings (in this case, photographs transferred on to the wood block) 'by the existence of a patent which presented obstacles too great to be surmounted at that time'.

While Talbot's interference proved no more than a nuisance, Pretsch's one-time manager of the firm, CAMPBELL DUNCAN DALLAS, caused more serious trouble. The only person with access to the secrets of Photogalvanography, he was only prevented from patenting 'certain chemical improvements' in June 1856 by being unable to furnish the detailed specification.

Dallastype. After Pretsch's patent had lapsed in November 1860 through lack of money to pay the renewal fee, Dallas took up the process, and with some modifications reintroduced it in 1863 as 'Dallastype'. He made no attempt to patent the method nor did he publish it, according to his own statement because he wanted to reap the fruits of his labours,[21] but according to J. M. Eder[22] because he had fraudulently appropriated Pretsch's invention. However that may be, the Dallastype specimen presented with *The Photographic News* of 1 January 1864 does surpass the results of Pretsch inasmuch as it was untouched by the engraver. We would not, however, go so far as did the editor in claiming that this engraving was 'the very best result of the kind ever produced' (up to 1864), for in France, less hampered by patent laws than England, great strides had been made in photo-engraving.

In 1869 Dallas formed a company called the Dallastype Works which accepted customers' orders for electro- and stereotype copies of woodcuts, pen and ink drawings, copper or steel-plate prints, and lithographs in line or chalk, but *not* half-tone photographs. These were apparently too difficult or too costly. In a pamphlet Dallas stated that over 25,000 copies could be machined off one type-metal block, and if transferred to stone the Dallastype would be found more efficient and more economical than other methods of photolithography. On 1 March 1875 Dallas issued a four-page 'Proposal for Divulging the Dallastype Process of Photographic Engraving to 500 subscribers or more at £20 each', declaring his intention to retire from business. The outcome is not known.

Heliogravure. Foremost among the experimenters in France was NIÉPCE DE SAINT-VICTOR, Commandant of the Louvre, who since 1853 had been trying to improve the bitumen process of his cousin Nicéphore. Eventually, in October 1855, a modified bitumen method on steel plates, worked out in collaboration with the engraver LEMAÎTRE, was perfected enough for the production of half-tone pictures. The two heliogravure portraits of Niépce made by A. Riffaut, which serve as frontispieces to his books *Recherches photographiques* and *Traité pratique de gravure héliographique*, are proof of the excellent quality that could be achieved in 1855 and 1856 respectively, 'with some assistance from an engraver' as Niépce admitted. Even before that time, on 7 October 1854 a perfect half-tone engraving of the Bibliothèque du Louvre by Mme P. Riffaut had been published in *La Lumière*, and what is particularly remarkable, it had been printed alongside the text of the journal on the same paper. Pl 319

In 1854 E. BALDUS and CHARLES NÈGRE, both painters as well as photographers, obtained good results with intaglio and relief engraving on a bitumen coating on steel. Whereas Baldus was chiefly interested in reproducing line engravings, Nègre obtained excellent half-tone pictures from nature with his own modification of heliogravure which required no retouching. An excellent half-tone picture, photographed and engraved by Nègre, was published in *La Lumière* on 21 October 1854, printed alongside the text. Nègre also obtained fine half-tone pictures by the collotype process in 1856 and by Photogalvanography in 1861. Very large engraved plates 24 in. × 18 in. shown by Nègre in 1859 were called 'finished performances', and having seen some impressive photo-engravings of architectural subjects, we would agree that they are perfect.

Nègre was runner-up to Poitevin for the Duc de Luynes's prize for a permanent printing process, and it was probably because he would not reveal the details that he was not awarded the prize. Eventually Nègre published his process in 1867.[23] He also made the heliogravures for the Duc de Luynes's publication of his travels in the Holy Land, 1867. HENRI GARNIER of Chartres worked out a very complicated variation of photoglyphy which gave good though somewhat grainy half-tone. A large view from nature etched by Garnier won the Grand Prix at the International Exhibition, Paris, 1867.

Photogravure. All these photo-engraving methods were surpassed by the photogravure process invented by KARL KLÍČ in October 1879. Klíč (pronounced Kleech), who had an engraving establishment in Vienna, used a polished copper plate to which fine resin dust had been caused to adhere by heat (as in Talbot's photoglyphy). A piece of carbon tissue (Swan's process) printed under a diapositive was then transferred to the grained copper plate, and by washing with warm water the soluble portions of the carbon image were removed. The plate was etched with perchloride of iron in successive baths of varying strength. After clearing off the gelatine the plate was seen to be etched in different depths in proportion to the tones of the picture, the shadows being deepest and consequently holding the most ink. Klíč kept details of his working procedure secret, and the unauthorized publication of his process by Lenhard in 1886 is said to have decided him to emigrate to England.[24]

Photogravure was worked under licence by many firms on the Continent. T. & R. Annan of Glasgow introduced it into Great Britain in 1883, and from that time the process has been given preference over other and cheaper reproduction methods for high-class publications. But as the plates were and still are costly to produce, photogravure paid only when large editions were required, for up to the end of the century one photogravure plate cost as much as the printing of a whole edition of the same picture by one of the other reproduction processes, such as collotype or Woodburytype, which is described in chapter 28.

Rotogravure. For the rapid printing of large editions it was important to adapt photogravure to rotary cylinder presses, which had been in use since 1877 for the reproduction of line drawings and engravings. This was achieved by Klíč in 1890, substituting a cross-line screen–already in use in the half-tone process–for the aquatint grain. He kept the method secret, however, and for this reason rotogravure has to be credited to another Viennese, ADOLF BRANDWEINER, who arrived at the same method independently and published it in 1892. It was only in August 1895 that rotogravure was commercially introduced into Britain by the Rembrandt Intaglio Printing Company, a firm founded in Lancaster by Klíč in collaboration with Samuel Fawcett. In later years their 'Rembrandt intaglio prints' were imitated by a number of firms, and often called by new names such as 'mezzotinto-gravure', 'Vandyke [*sic*] gravure', etc. The first British periodical to be printed by rotogravure was *The Illustrated London News* in 1895. On 12 October 1912 the paper started a regular rotogravure section of eight pages, with the type set on the same cylinder as the picture.

A photogravure process of an entirely different nature was invented by J. B. OBERNETTER of Munich about 1886. In this 'Lichtkupferdruck' a negative was converted into a chloride of silver positive and the film stripped and placed on the surface of a copper plate. By electrolysis the silver chloride was decomposed, the chlorine uniting with the copper and etching it to a greater or less degree according to the depth of deposit of silver chloride of the original. The result was a grained intaglio plate of extreme delicacy, which was inked and printed from like an ordinary etching. The advantage claimed by the inventor was that he could prepare the largest size printing plate in a couple of days (instead of several weeks) and that 21,000 prints could be pulled, provided the plate was frequently re-steeled.

2 SURFACE PRINTING PROCESSES

(*a*) *Photolithography.* Twenty-five years after NICÉPHORE NIÉPCE's abortive attempts at photolithography, DR ANDREW FYFE of Edinburgh, at the suggestion of a local lithographer named Nichol, coated lithographic stone with silver phosphate, and laid on it an object or an engraving which impressed its image. This was then traced over with lithographic transfer ink by hand. In describing his idea to the Society of Arts for Scotland on 17 April 1839[25] Dr Fyfe explained that by this means a great deal of time and labour was saved, besides achieving a much more accurate result. He showed a Photogenic Drawing of dried ferns, which had been lithographed and impressions taken in the course of 2 hours. Ten days later G. Francis, printer of *The Magazine of Science*, described in that journal his method of sensitizing boxwood blocks on which he obtained two Photogenic Drawings of plants, and one of lace 'fit for the graver without any further preparation'. Prints from these photographically prepared woodcuts were published in the same journal on 27 April–the first application of photography to wood engraving.

During the next fifteen years numerous photolithographic processes were devised. In some, the stone was coated with a solution of bitumen in ether, benzole, or turpentine; in others, the sensitive coating consisted of bichromate of potash with albumen or gelatine. The following table lists the more important of the early methods and their dates.

Bitumen

Zurcher, Paris, 1842.
Davanne, Barreswil, Lemercier & Lerebours, Paris, 1852.
Hermann Halleur, Bochum, 1854.
Robert Macpherson, Rome, 1855.
Karl von Giessendorf (Imperial Printing Office), Vienna, 1861.

Bichromate of Potash

Joseph Dixon, Massachusetts, 1841.
A. Poitevin, Paris, 1855.
Rousseau & Masson, 1856.
John Pouncy, Dorchester, 1857.
J. A. Cutting & L. H. Bradford, Boston, 1858.
E. I. Asser, Amsterdam, 1859.
J. W. Osborne, Melbourne, 1859.
Francis S. Beattie, Dublin, 1860.
William Toovey, Brussels, 1863.
Edward & James Bullock, Leamington, 1865.

Photolithography was admirably suited to copying line subjects–engravings, manuscripts, rare books, maps, etc.–but not for copying photographic pictures. Of the few inventors who succeeded in obtaining half-tone, the first were the chemists BARRESWIL and DAVANNE working in collaboration with the optician LEREBOURS and the printer LEMERCIER. In 1852 they revived NICÉPHORE NIÉPCE's bitumen process, replacing his metal plate by grained lithographic stone, and coating it with a solution of bitumen of Judea in ether (instead of oil of lavender). After exposure under a negative, ether was used as the dissolvent. The stone was then etched with acid and inked. The parts where the bitumen, made insoluble by light, had prevented the action of the acid 'took' the ink. In 1854 Lemercier published under the title *Lithophotographie*[26] the first six prints, each 33 cm. × 23 cm., of which one was a detail of Chartres cathedral. They showed good half-tone, but the process was later abandoned in favour of Poitevin's, because only a limited number of proofs could be pulled.

ALPHONSE POITEVIN introduced an entirely new method in August 1855, based on his discovery that bichromated gelatine, glue, albumen, or gum become not only insoluble when acted on by light, but also water repellent, whilst the parts unaffected by light retain their normal property of absorbing water. He found further that when such a coating, after exposure under a negative, was moistened and greasy lithographic ink applied, it adhered to those parts which had been acted on by light and which were water repellent, but not to those which were unaffected by light and therefore moist. The stone–which acted merely as a support for the printing surface–was then treated by the usual lithographic method of slight acidulation and rolling up with greasy ink for printing.

In October 1855 Poitevin started a small photolithographic printing establishment in Paris, where he produced a large number of plates for a variety of publications, including an album of forty-five plates of terracottas, plates of Gothic architecture from photographs by Bisson and Berthier, a series of landscapes from waxed-paper negatives by Comte Aguado, Egyptian stone inscriptions at the Louvre, etc. He could pull 300 copies from each stone.[27] Exactly two years later, when pressed for money for further inventions, he sold his patent rights for 20,000 francs to Lemercier, who being an experienced lithographer got 700 copies from each stone.

JOHN POUNCY's *Dorsetshire Photographically Illustrated* was the first book illustrated by photolithography to be published in Britain. A survey of mansions, churches, and other places of interest in Dorset, the work was published by subscription in four parts (two oblong folio volumes) in 1857, the first volume containing thirty-nine and the second forty plates. 'The detail and touch of nature faithfully reproduced by a new process on stone by which views are rendered truthful, artistic, and durable.' However, photography did only part of the work and Pouncy himself admitted as much in stating that he 'has engaged artists of high standing to assist him in carrying out his new process of photographs on stone'. As far as we know, Pouncy's rare book was not only the first but remained the only attempt in book form to reproduce photographic views from nature by photolithography.

The second book to be illustrated by photolithography in Britain was not concerned with representing half-tone. It was a facsimile of 'Hamlet, photographed and transferred to stone and from stone to paper by Mr Netherclift'. Only forty copies were made by J. Netherclift & Son, for the Duke of Devonshire, in 1858.

In September 1859 J. W. OSBORNE, head of the Government Survey Office in Melbourne, introduced a modification of E. I. ASSER's transfer process, for the reproduction of government plans and maps. Two months later he read a paper on this application to the Philosophical Institute of Melbourne. The image was formed on transfer paper coated with bichromated gelatine, and then transferred to stone. This method allowed a much greater number of impressions to be taken–an edition of 2,000 to 3,000 as against Lemercier's 700 by Poitevin's process. Osborne stated that the reduction of a map by a draftsman required three and a half days and cost

£3 9*s*. 6*d*., whilst by photolithography it was completed in 2¾ hours and cost only 6*s*. 6*d*.[28] The Government of Victoria showed their appreciation of the considerable saving that this application made possible by presenting Osborne with a cheque for £1,000.

Photozincography. Six months later, COLONEL SIR HENRY JAMES, F.R.S., Osborne's opposite number at the Ordnance Survey, Southampton, independently introduced the same process, but transferred to zinc (also suggested by Asser in 1859).[29] James included a specimen of photozincography and a brief note on the method in his annual Report to Parliament for the year 1859, a fuller description being published in *Photozincography* (1860), a pamphlet which James wrote jointly with CAPTAIN A. DE COURCEY SCOTT, who had charge of this department at Southampton. An interesting history of photozincography with twelve plates showing a variety of applications is contained in a larger publication of the same title published by James and Scott in 1862.

By the use of this quick and accurate method of making facsimiles or reductions in scale of official maps at Southampton, it was estimated that an annual saving to the Treasury of £30,000 was effected. Photozincography was by far the quickest and cheapest method of completing the survey of Britain which had been started in 1799 and was not completed until January 1870, by which time, of course, all the earlier sections were hopelessly out of date. It saved the Government the long and expensive procedure of altering the old steel plates, or in the case of expanding industrial districts, the necessity of hand-engraving new plates. Besides Ordnance Survey maps, facsimiles of parts of the Domesday Book were published in 1861 (Cornwall) and 1862 (Hampshire). The Ordnance Survey Department also undertook facsimile reproductions for a large number of books,[30] and instructed officers of nearly every European country in this method of map making–a rare occasion, indeed, on which the War Office was willing to reveal a secret to foreign powers. Pl 320

The best *half-tone* photolithographs in England were produced by E. & J. BULLOCK of Leamington in the mid-1860s. Their method (patented on 17 November 1865) consisted in breaking up the continuous tints of the photograph by specks of ink, which was achieved by copying a photograph on to transfer paper which had been coated with gelatine, impressed with grain from an aquatint plate, and then sensitized with bichromate of potash. The transfer paper was then inked and pressed on the stone. Transfer paper prepared with aquatint grain, but not sensitized, was supplied by Bullock Brothers to their licensees. At least 2,600 prints could be pulled from one stone at a rate of 500 to 600 a day.[31] Pl 321

(*b*) *Collotype*. The principle underlying collotype (Greek κόλλα, glue) is contained in POITEVIN's patent of August 1855 (English patent No. 2815, December 1855). There he observes that if stone, metal, glass, or wood is coated with bichromated gelatine (or similar organic substance) and exposed under a negative and moistened with water, the coating becomes capable of accepting greasy ink only on the exposed parts in proportion to the action of light. This makes it possible to produce prints direct from the gelatine, fine grain being formed by the reticulation of the gelatine during drying. Poitevin himself called this reproduction process photolithography, as he used it only on stone.

The first to achieve good practical results in collotype was F. JOUBERT, a French engraver who was associated with Camille Silvy, the fashionable portrait photographer in London. He presented with the June issue of *The Photographic Journal*, 1860, a picture which he had printed six months earlier from one of Silvy's negatives. Pl 322

Joubert's 'Phototype' could not be bettered today. It has perfect photographic half-tone, far surpassing anything else achieved by that date, so it is not surprising that he received many enquiries as to the printing method. However, Joubert did not feel ready to publish it freely, nor did anyone else exploit it commercially when he offered to sell the rights, his own time being completely absorbed by ceramic photography[32] (see chapter 28). The manipulation remained a secret for ever, which was regrettable in view of the excellent results, and the apparent facility in printing an edition of approximately 2,000 (the edition of *The Photographic Journal* at that time).

C. M. TESSIÉ DU MOTAY and C. R. MARÉCHAL of Metz who followed Joubert's steps (English patent, 14 March 1865) did not achieve perfect half-tones; moreover the gelatine printing surface peeled off the copper plate which they used as base after sixty to seventy prints had been pulled. Later, the surface was toughened by acidifying the bichromated gelatine, and the process was worked commercially by M. Aroza.

Albertype. It was not until 1868 that a perfected collotype process was introduced, and then–as so often happens–three people quite independently evolved within a few months of each other very similar methods, all based on the process Poitevin called photolithography. The first was that of JOSEF ALBERT, the Bavarian Court photographer, who named the method after himself Albertype–rather unfairly to Poitevin. He succeeded in making the bichromated gelatine adhere firmly to a finely ground glass plate by a ground-coat of the same substance which had been hardened by exposure to light. He was able to print over 2,000 copies without deterioration of the gelatine. Albertypes show very fine half-tone. By using suitable coloured printing inks, a thicker one for the shadows–the less absorbent parts–and a thinner one for the half-tones, Albert obtained prints indistinguishable from actual photographs on plain salted paper, or, by glazing, they could be made to resemble albumen prints. They were very cheap, a 20 in. × 14 in. print cost only one shilling. The trouble and cost of making a plate was said to be about the same as that of producing an ordinary photograph, but instead of the lengthy process of making photographic prints, 200 impressions could be taken daily from one plate on a hand printing-press. (With the Woodburytype the same number of prints per day required six presses.)[33] This number was greatly increased when five years later Albert employed rapid rotary presses similar to those in use for lithography.

From about 1870 on, the Albertype was worked in England by Spencer, Sawyer, Bird & Co., a subsidiary of the Autotype Company at Ealing. Among outstanding work produced by this firm is the Utrecht Psalter, reproduced for the Palaeographical Society, and a work on coins for the Numismatical Society.

Lichtdruck. PROFESSOR JAKOB HUSNIK, a drawing master in Tabor, Bohemia, MAX GEMOSER, a Munich lithographer, and J. B. OBERNETTER, also of Munich, introduced collotype processes very similar to Albert's. Husnik applied a substratum of water-glass and albumen, but though simpler to manipulate this did not give such good adhesion as Albert's bichromated gelatine substratum, and he consequently could pull only about 1,000 prints. Husnik had, however, considerable success with the prints he published, and Albert thought it advisable, therefore, to remove competition by buying the process in January 1869.[34]

Gemoser (like Poitevin) applied collotype to lithographic stone instead of glass, yet his prints are indistinguishable from Albert's. He introduced his process under the name 'Lichtdruck', which term was also applied to Albert's.

Heliotype. In the Heliotype, a modified collotype introduced by the London portrait photographer ERNEST EDWARDS in December 1869, the sensitive coating of bichromated gelatine, which contained chrome alum to harden it and prevent the unexposed gelatine from swelling, was formed on a waxed glass plate, and then stripped off. The film was given a short exposure on the *back* of the coating to harden it, either before or after exposure under a reversed negative. It was then attached by rubber solution to a pewter plate for development with warm water, and printing. Two printings were made—with thick ink for the shadows, and thin ink for the half-tones. The prints were more vigorous than Albert's because the metal plate could be subjected to stronger pressure than glass. One thousand five hundred impressions could be obtained from a single plate at the rate of 200–300 impressions a day.[35] Quarto size book illustrations could be supplied ready for the binder at a cost of 1½*d.* each.

The Heliotype process was worked by Edwards in partnership with R. L. Kidd at Kilburn, London. Of the many books and magazines illustrated with Heliotypes we should mention the *Photographic Art Journal*, March–June 1870, a monthly magazine published by Sampson Low & Marson, London, which continued under the title *Art Pictorial and Industrial* from July 1870 to April 1875. The first book illustrated with (20) Heliotypes, mainly from negatives by O. G. Rejlander, was Darwin's *The Expression of the Emotions in Man and Animals* which appeared in 1872. In this year the Heliotype Company had seventy-five employees and was in a position to undertake an order for 110,000 prints from the same subject within eight days—printed no doubt from several plates at the same time.[36] The process was introduced into America, France, Belgium, and Italy.

The first to offer a printing service in permanent ink for photographers was ALFRED PUMPHREY of Birmingham, about 1877. All a photographer had to do was to send his negative to Pumphrey, who made a collotype plate from it. The price for the minimum quantity of 100 prints size 5½ in. × 8¼ in. was 12*s.*; for 1,000, £4. Prints size 8¼ in. × 10½ in. cost 18*s.* 6*d.* for 100, £6 10*s.* 0*d.* for 1,000.[37] The exact mode by which these ink photographs were produced was not revealed.

3 PHOTO-TYPE BLOCK ('HALF-TONE PROCESS')

The half-tone (relief) process is the one most commonly employed nowadays for the reproduction of photographs in books and newspapers, and up to about 1912 it was the only one that could be printed simultaneously with type. In the *intaglio* processes the half-tone of the photograph was produced on the metal plate or stone by forming a natural grain, either by dusting the plate or stone with resin, or by incorporating gritty matter in the sensitive coating. In *surface* printing use was made of the reticulation of the bichromated gelatine as well as of its property of accepting greasy ink in proportion to the action of light. In the *relief* photo-engraving process, half-tone is achieved by breaking up the photographic image into fine dots of varying size, the largest, taking most ink, printing the shadows; the smallest, taking least ink, the highlights; intermediate sized dots printing the half-tones. This dot image is transferred to the metal plate, and the dots etched into relief for printing along with the type. The dots are produced by photographing through a screen, which is called coarse or fine according to the number of lines per inch it contains.

The first suggestion to break up the photographic image into dots by means of a network screen came from TALBOT, who in his patent of 29 October 1852 mentions using folded gauze. Alternatively he suggested placing a glass plate 'covered with an innumerable quantity of fine lines, or else with dots and specks, which must be opaque and distinct from each other' between the photograph, or object to be copied, and the sensitive plate.[38]

Various investigators took up Talbot's ideas and developed them, including A. J. BERCHTOLD (glass screen, December 1857), C. J. BURNETT (glass screen, 1858), E. & J. BULLOCK (gauze and paper screens, November 1865), FREDERICK VON EGLOFFSTEIN (glass screen, November 1865). Perhaps the most interesting of these inventions were J. W. SWAN's devices for obtaining half-tone. He suggested in his patent of July 1865 the formation of numerous opaque lines or dots (according to the effect desired) on the negative of the subject to be engraved. The parallel or intersecting lines were to be obtained by taking a photograph of a glass plate coated with opaque etching ground, on which the required lines were scratched with a ruling machine. The dots were made by taking a photograph of a dark screen perforated with numerous minute holes. This negative was then copied on to carbon tissue, and after development by washing, the gelatine relief was electrotyped, producing a copper-plate which could be used in the ordinary way of engraving. However, all these ingenious suggestions came before the time was ripe, for the half-tone process was of vital importance only for newspaper illustration. For book or magazine illustration collotype, Woodburytype, or photogravure answered all requirements, and before the phototype block emerged from the experimental stage, these experimenters and their patents were forgotten. Only Swan returned to the idea, fourteen years later. He advocated in his patent of 22 July 1879 a screen ruled with about 100 lines to an inch. This screen he suggested placing in the camera in front of the plate when copying a positive photograph, and turning it during exposure so that double the number of intersecting lines be obtained. In this Swan anticipated Georg Meisenbach by three years, though the latter was the first actually to practise such a method.

Physical system of producing dots. Meanwhile, in August 1878, CHARLES PETIT of Paris and FREDERIC EUGENE IVES of Philadelphia patented within a week of each other a system of obtaining half-tone totally different from the screen method, but closely resembling one another's. They did not, however, apply the system in the same manner.

Petit blackened the surface of a white photographic relief, and incised (white) lines with a V-shaped tool. In Ives's process, which was commercially introduced in Philadelphia in June 1881, a gelatine relief was cast in white plaster, and then a sheet of rubber covered with raised V-shaped points or little pyramids was pressed upon it after inking. Depending on the amount of relief on the cast, the rubber points were more or less spread out, and made dots of ink of varying sizes on the surface of the cast, accurately reproducing the light and shade of the image. The cast was then photographed, and the negative printed on a bichromated gelatine plate in the usual way. In a later improvement, the cast was coated with plain collodion which took off the ink dots. The film of collodion was then copied by contact on a gelatine dry plate.

Ives's system of producing half-tone was the first practical method and for over a year the only one in the world in successful commercial operation (by the Crosscup & West Engraving Co., Philadelphia).[39] Then in May 1882 GEORG MEISENBACH, a Munich engraver, patented a single-line screen made by photographing a print from an engraved copper-plate ruled with lines. This negative was placed in front of a diapositive of the picture to be reproduced, and the two photographed together. Half-way through the exposure the screen was turned 90° resulting in cross-lines on the negative–as Swan had suggested in 1879. The new negative was exposed on a zinc block coated with bichromated gelatine, and this was etched to form a typographic block. The process was successfully worked by Meisenbach & Co. in Munich and London, where a branch was opened in 1884. For many years this firm was the leading blockmaker in Britain.

The cross-line screen. The next advance in blockmaking was made in 1886 when Ives introduced the cross-line screen, consisting of two line screens cemented together face to face at right angles. Ives made the lines by ruling with a machine on photographically blackened collodion plates. He also investigated the relationship of screen distance from the sensitive plate and the shape of the lens diaphragm, which he found influenced the dot formation, stating correctly the basic principles. Ives is considered the founder of the modern half-tone process, because two Englishmen, H. Garside and Alexander Borland, who had patented the correct principles of making and using line screens in 1883, have been overlooked.

The last important improvement in the half-tone process was made in 1890 by MAX LEVY, also of Philadelphia. He perfected Ives's glass screens, by etching the lines into the glass and then filling them with black resin. With this step the half-tone process was established more or less in the form in which it is today. Screens of varying degrees of fineness are now used, from 60 lines per inch for coarse newspaper work, up to 400 lines per inch for extremely fine art reproductions; the normal run of book and magazine illustrations are made through a screen of between 120 and 150 lines.

Photographs in newspapers. The half-tone block opened up a new epoch in the history of journalism, and the first photograph (from a half-tone block by S. H. HORGAN's process) appeared in *The Daily Graphic*, New York, on 4 March 1880. It was a view of 'Shantytown', New York, by H. J. Newton, and the editor stated: 'We have dealt heretofore with pictures made from drawings or engravings. Here we have one direct from nature. . . . There has been no re-drawing of the picture. The transfer print has been obtained direct from the original negative. As will be seen, certain of the effects are obtained by the use of vertical lines. This process has not yet been fully developed.' It was a coarse picture, a single-line screen with only 70 lines per inch being used.[40] *The Photographic News*, which was among the first British journals to employ the new method of illustration as an experiment, commented in 1884: 'Not only is the engraved block made entirely by photographic agency, but it represents current news, and what is perhaps of more importance, it was printed satisfactorily along with the rapidly machined letterpress.' A year later, the weekly *Graphic*–long considered one of the strongholds of the wood-engraver–issued a supplement of fifteen photographs by the half-tone process. Yet, surprising as it may seem, development was extremely slow and up to the end of the century woodcuts, copied from photographs or artists' drawings, remained the common form of illustration for weeklies and magazines. For the cheap illustrated newspapers which could not afford expensive woodcuts, a quick and economical substitute was found in zinc phototype blocks of artists' drawings. A city firm specializing in this work made phototype blocks at the low charge of 3½*d.* to 5*d.* per sq. in. in a couple of days.[41] This was the first step in photography's entry into the newspaper world. In July 1885 some progressive business men tried to establish a firm in London for the purpose of supplying newspapers with half-tone blocks. But judging from the lack of interest then prevailing, it is doubtful whether the idea ever got farther than a printed circular in which the firm offered 'Portraits and scenes of general interest [which] will be produced regularly as the events of the day bring them into public notice, and lists of those on hand will be published for the information of customers'.[42] Seventy years ago newspaper editors were less concerned about exclusiveness than they are today–and there was no such frantic hurry as now to get topical picture material. Nowadays it is hardly possible to imagine an evening paper without photographs of the afternoon's events.

In January 1890 appeared the *Daily Graphic*, the first British picture daily, and by the beginning of 1892 both this and *The Illustrated London News* were drawing largely, but not exclusively, upon photography–but still only for copy as woodcuts, not as half-tone illustrations. Very slowly photographs began to edge their way into the press and to be specially taken for newspapers. George Eastman's prophecy in June 1885 that 'the camera is getting to be as necessary to the newspaper correspondent as the pen'[43] was beginning to come true, though it was not until January 1904 that the London *Daily Mirror* became the first daily newspaper in the world to be illustrated exclusively with photographs (see chapter 36).

Conclusion

THE NECESSITY FOR PUBLIC COLLECTIONS OF PHOTOGRAPHY

The authors would not like to close this history without once more drawing attention to the urgent need to establish public collections[1] of photography to foster appreciation and study.

Though there exist a number of photographic collections for the documentation of specialized subjects such as archaeology, art history, geology, topography, war records, etc., we lack up till now in Europe public institutions showing photography as an art in its own right.

Photography has been acclaimed as the 'greatest discovery since that of the printing press', and with its related media the film and television it constitutes today the most important medium of communications. All the more astonishing is the fact that up to the present not a single public museum in Europe gives space to the permanent display of photographs as pictures, or the thousand-fold applications of photography to education, science and industry. Future generations will regard photography as the historian of the present age even more than we do today, and will therefore depend to a still greater extent on photographs of the past than on the printed word: places must be provided where such photographs are available for study by the public. To regard commercial picture agencies and newspaper files as the guardians of historic records is rather the same as to suggest that scholars should do their research in publishers' stockrooms. The need for public reference libraries for books has long been recognized, and the establishment of public archives of photographs is much overdue, for whilst an edition of a book is usually numbered in thousands of copies it is exceptional for more than a handful of prints to be made of any one photograph. Hence the necessity for preserving photographs is immeasurably greater.

A number of collections have been formed devoted to photographic equipment and the technique of photography, but few of them are open to the public, and without a catalogue and expert staff they are bound to remain largely dormant, thus defeating the object for which they were formed.

Its brief history of 140 years has seen many great masters of the photographic medium and a wealth of impressive pictures which the present generation is beginning to re-discover and appreciate. It is equally stimulating to observe how the image is continually reshaped by contemporary trends.

In 1926 Roger Fry wrote 'Mrs. Cameron's photographs already bid fair to outlive most of the works of the artists who were her contemporaries. One day we may hope that the National Portrait Gallery may be deprived of so large a part of its grant that it will turn to foster the art of photography, and will rely on its results for its records instead of buying acres of canvas covered at great expense by fashionable practitioners in paint.' These words apply equally to the work of a great many other portrait photographers of the present as well as of the last century. No less urgent is the preservation of photographs of architecture, topography, news events and social documentation–all fields in which photography has proved its supremacy over other means of illustration.

The George Eastman House, Rochester, N.Y., the Museum of Modern Art, New York, the Folkwang Museum in Essen, the Photokina Exhibitions in Cologne, and the Department of Prints at the Bibliothèque Nationale, Paris, have through their activities in the form of exhibitions, publications and lectures, done much to further the subject.

If our own books and exhibitions from our collection have helped to give impetus to the growing world-wide awareness of photography as an independent art medium, the task of preserving and making available photographs of the past and the present is too immense for private individuals. Not only should every country have its national museum of photography, but each town of consequence should have its photographic archive. In this photographs showing the continual change in its appearance, and the life and history of that town, and portraits of its leading citizens, should be preserved as local history for future generations.

Photography is still a young art form, but unless the systematic collection of photographs of aesthetic, scientific or documentary merit is undertaken immediately, the risk of losing valuable examples through neglect is daily growing. In the last forty years or so many irreplaceable photographs illustrating the evolution of the art have only been saved from being discarded through the dedicated interest and care of a handful of enthusiastic collectors.

It is to be hoped that the new photo-historical collections in course of being built up in Europe, America, and Australia, will concentrate on fine photographs, rather than on the traditional agglomerations of equipment and lenses, with photographs merely as examples of processes.

Notes on the text

Part I THE PREHISTORY OF PHOTOGRAPHY

1 The history of the camera obscura

[1] Professor E. Wiedemann in J. M. Eder's *Jahrbuch für Photographie,* 1910, p. 12.

[2] Roger Bacon, *Perspectiva,* Combach's edition, Frankfurt, 1614, p. 166.

[3] Joannis Pisanais [de Peckham], *Perspectiva vulgo communis appellata rationes visus in radiationibus ac lineis visualibus,* 38 ll., Leipzig, 1504, Part I, prop. 5.

[4] MS. no. 7281, folio 143, at the Bibliothèque Nationale, Paris. First translated and published by E. Littré in *Histoire littéraire de la France,* vol. xxv, Paris, 1869.

[5] *Theoricae novae planetarum Georgii Purbachii Germani ab Erasmo Reinholdo auctae,* Wittenberg, 1542, pp. 131–2.

[6] Gemma-Frisius, *De radio astronomico et geometrico liber,* Antwerp and Louvain, 1545, p. 32.

[7] Giorgio Vasari, *Lives of the Painters, Sculptors and Architects,* Everyman's edition, 1927, vol. i, p. 347.

[8] Giorgio Vasari, *Vite de' più eccellenti pittori, scultori e architetti,* Milan, 1807–11, vol. v, p. 81.

[9] Gainsborough's apparatus and glass paintings were reproduced in *The Illustrated London News,* 20 Jan. 1934. They are at the Victoria & Albert Museum, London.

[10] MS. in the Biblioteca Ambrosiana, Milan, with a diagram on folio 337, recto a.

[11] MS. in the Institut de France, Paris, folio 8.

[12] Venturi, *Essai sur les ouvrages physico-mathématiques de Léonard de Vinci,* Paris, 1797.

[13] Vitruvius, *De architectura libri dece, traducti de latino in vulgare affigurati,* Como, 1521, book i, leaf 23, verso.

[14] Hieronymi Cardani, *De Subtilitate libri xxi,* Nuremberg, 1550. In book iv, p. 107.

[15] Jo. Baptista Porta, *Magiae naturalis, sive de miraculis rerum naturalium, libri iiii,* Naples, 1558.

[16] Jo. Baptista Porta, *Magiae naturalis libri xx,* Naples, 1589.

[17] *Natural Magick by John Baptista Porta, a Neapolitaine: in twenty books,* published by Thomas Young and Samuel Speed, London, 1658, pp. 363 et seq. Second English edition published by John Wright, London, 1669. The *first* description in English of the camera obscura (based on Porta) is contained in Henry van Etten's [pseud. for Claude Mydorge] *Mathematicall Recreations,* London, 1633, Problem II, pp. 6–9, with two small illustrations. This was an amended edition with critical comments by W. Oughtred of an earlier work by Jean Leurechon, *Examen du livre des récréations mathématiques,* Paris, 1624.

[18] Daniele Barbaro, *La Pratica della perspettiva,* Venice, 1568, chap. v, p. 192.

[19] Ignatio Danti, *La prospettiva di Euclide,* Florence, 1573.

[20] Jo. Batistae Benedicti, *Diversarum speculationum mathematicarum et physicarum liber,* Turin, 1585, p. 270.

[21] Daniel Schwenter, *Deliciae physico-mathematicae,* Nuremberg, 1636, p. 255. Posthumously published.

[22] Kaspar Schott, *Magia universalis naturae et artis,* Herbipoli (Würzburg), 1657, p. 87.

[23] Friedrich Risner, *Opticae,* posthumously published, Kassel, 1606.

[24] Athanasius Kircher, *Ars magna lucis et umbrae*, 1st ed., Rome, 1646, plate 28.

[25] Christopher Scheiner, *Rosa ursina sive sol*, Bracciano, 1630, chap. 8, plate facing p. 151.

[26] *Reliquiae Wottonianae*, 1st ed., London, 1651, p. 413.

[27] This account was reprinted almost verbatim in a manual for artists entitled *Graphice, the Use of the Pen and Pencil, or the most excellent Art of Painting*, by William Sanderson, published by R. Crofts, London, 1658, p. 86.

[28] Illustrated in Abbé Nollet, *Leçons de physique expérimentale*, vol. v, Paris, 1755, plate 6.

[29] Johann Kepler, *Ad Vitellionem paralipomena*, Frankfurt, 1604, p. 51.

[30] Johann Kepler, *Dioptrice*, Augsburg, 1611, problem xliii, p. 16.

[31] Leonard Digges, *A Geometrical Practise, named Pantometria*, London, 1571.

[32] Kaspar Schott, *Magia universalis naturae et artis*, Herbipoli (Würzburg), 1657, book iv, p. 200.

[33] Pierre Hérigone, *Supplementum cursus mathematici*, Paris, 1642, chap. 6, p. 113. Illustrated in Johann Zahn, *Oculus artificialis*, 1685, plate xxiii.

[34] J. Ch. Kohlhans, *Neu-erfundene mathematische und optische Curiositäten*, Leipzig, 1677, fig. 302.

[35] Robert Boyle, *Of the Systematicall and Cosmical Qualities of Things*, Oxford, 1669.

[36] No reference to this could be found.

[37] *Phil. Trans. Roy. Soc.*, no. 38, vol. iii, 1668.

[38] *Posthumous Works of Robert Hooke*, edited by Richard Waller, London, 1705, p. 127.

[39] Contained in *Philosophical Experiments and Observations of the Late Eminent Dr Hooke*, edited by W. Derham, London, 1726.

[40] Johann Christoph Sturm, *Collegium experimentale, sive curiosum*, Nuremberg, 1676, tentamen xvi.

[41] Johann Zahn, *Oculus artificialis teledioptricus, sive telescopium*, Würzburg, 1685–6. Eder erroneously gives the date as 1665 and every writer on the subject, including Potonniée and Lécuyer, has copied this error. A second edition was published in 1702.

[42] John Harris, *Lexicon technicum*, London, 1704.

[43] Op. cit.

[44] William Cheselden, *Osteographia, or the Anatomy of the Bones*, London, 1733.

[45] *Saggio sopra la Pittura*, Leghorn, 1763. English translation, Glasgow, 1764.

[46] G. J. s'Gravesande, *Usage de la chambre obscure pour le dessein* (part of *Essai de perspective*), The Hague, 1711.

[47] *Hannoverische Gelehrte Anzeigen*, No. 44, 1753.

[48] Georg Friedrich Brander, *Beschreibung dreyer Camerae Obscurae nebst Unterricht wie man sich derselben bedienen solle*, Augsburg, 1769.

[49] Guyot, *Nouvelles récréations physiques et mathématiques*, vol. iii, Paris, 1770, plate 20.

[50] Joseph Harris, *A Treatise on Optics*. Posthumously published, London, 1775, book ii, pp. 269–82.

[51] Lawrence Sterne, *The Life and Opinions of Tristram Shandy*, London, 1760, vol. i, p. 171.

[52] Two camera obscuras which belonged to Goethe are preserved at the Goethehaus, Weimar.

[53] J. W. von Goethe, *Die Wahlverwandschaften*, Tübingen, 1809, part ii, chap. 10.

[54] James Bruce, *Travels to discover the Source of the Nile in the Years 1768–1773*, introduction, Edinburgh, 1790.

[55] R. Playfair, *Travels in the footsteps of Bruce in Algeria and Tunis*, London, 1877.

[56] Edward Dodwell, *A Classical and Topographical Tour through Greece*, vol. i, London, 1819.

[57] John Dollond, 'An account of some experiments concerning the different refrangibility of light', *Phil. Trans. Roy. Soc.* 1758, vol. L, p. 733.

[58] William Hyde Wollaston, 'Description of the camera lucida', *Nicholson's Journal*, vol. xvii, June 1807.

2 *Photochemical investigations*

[1] Georgius Fabricius, *De metallicis rebus*, Zurich, 1565, chapter 'Argentum'.

[2] Angelo Sala, *Septem planitarum terrestrium spagirica recensio*, Amsterdam, 1614. Also incorported in his collected works *Opera medico-chymica*, Frankfurt, 1647.

[3] *Histoire de l'Académie Royale des Sciences à Paris depuis 1686 jusqu'à 1699*, vol. ii, p. 129.

[4] Robert Boyle, *General History of the Air*, London, 1692.

[5] Count Rumford, 'An Inquiry concerning the chemical Properties that have been attributed to Light', *Phil. Trans. Roy. Soc.*, June 1798.

[6] *Acta physico-medica Academiae Caesariae,* Nuremberg, 1727, vol. i, p. 528. Observatio 233. An English translation was published by R. B. Litchfield in *The Photographic Journal,* 30 Nov. 1898.

[7] *Dr Joh. Heinr. Schulzens Chemische Versuche, nach dem eigenhändigen Manuscript des Herrn Verfassers zum Druck befördert durch D. Christoph Carl Strumpff,* Halle, 1745, p. 119.

[8] *Histoire de l'Académie Royale des Sciences, année 1737,* Paris, 1766.

[9] Contained in *De Bononiensi Scientiarium et Artium Instituto atque Academia Commentarii,* vol. iv, Bologna, 1757.

[10] Dr William Lewis, *Commercium philosophico-technicum,* London, 1763, p. 350.

[11] Mentioned in Samuel Parkes's *Chemical Catechism,* London, 1806, p. 15.

[12] Eliza Meteyard, *Life of Josiah Wedgwood,* London, vol. ii, 1866, p. 465.

[13] Carl Wilhelm Scheele, *Aeris atque ignis examen chemicum,* Uppsala and Leipzig, 1777, and *Chemische Abhandlung von der Luft und dem Feuer,* Uppsala and Leipzig, 1777. English translation entitled *Chemical Observations and Experiments on Air and Fire,* London, 1780. French translation, *Traité chemique de l'air et du feu,* Paris 1781.

[14] Jean Senebier, *Mémoires physico-chymiques sur l'influence de la lumière solaire pour modifier les êtres des trois règnes de la Nature, et surtout ceux du règne végétal,* Geneva, 1782, 14th memoir, vol. iii.

[15] Dr Joseph Black, *Lectures on the Elements of Chemistry.* Posthumously published by John Robinson, Edinburgh, 1803, 2 vols.

[16] William Herschel, 'Experiments on the refrangibility of the invisible rays of the sun', *Phil. Trans. Roy. Soc.* 1800, p. 284.

[17] J. W. Ritter, *Gilberts Annalen der Physik,* vol. vii, 1801, p. 527.

[18] William Hyde Wollaston, 'A Method of examining refractive and dispersive Powers by prismatic Reflection', *Phil. Trans. Roy. Soc.,* June 1802, p. 379.

3 Phantoms of photography

[1] Tiphaigne de la Roche, *Giphantie,* 1st edition, 'à Babylone' (Paris), 1760. English translation entitled *Giphantia,* London, 1761.

[2] François de Salignac de la Mothe [Fénelon], *Les Aventures de Télémaque, fils d'Ulysse,* 1699. The story appears in 'Un voyage supposé'.

[3] *The Life and Times of Henry, Lord Brougham, written by himself,* 3 vols. Posthumously published, Edinburgh, 1871, vol. i, p. 69.

[4] H. de la Blanchère, *Répertoire encyclopédique de photographie,* Paris, 1863, vol. i.

4 The first conception of photography

[1] Quoted by Eliza Meteyard in her *Life of Josiah Wedgwood,* London, 1865–6.

[2] *Phil. Trans. Roy. Soc.* 1792, pp. 28–47.

[3] Dr Joseph Priestley, *The History and Present State of Discoveries relating to Vision, Light and Colours,* London, 1772.

[4] R. B. Litchfield, *Tom Wedgwood, the First Photographer,* London, 1903.

[5] *The Mechanics' Magazine,* London, 9 Feb. 1839. Letter from Sir Anthony Carlisle.

[6] *Journal of the Royal Institution,* vol. i, No. 9, 22 June, London, 1802, p. 170. Reprinted in full in *Nicholson's Journal of Natural Philosophy,* vol. iii, Nov. 1802, p. 167; *Collected Works of Sir Humphry Davy,* edited by John Davy (his brother), vol. ii, London, 1839; *The Liverpool and Manchester Photographic Journal,* vol. i, 1857, p. 152; *Bulletin de la Société Française de Photographie,* vol. iii, Nov. 1857, p. 350. *The Photographic Quarterly,* vol. i, London, 1890, p. 170; *Photography,* London, May 1902; R. B. Litchfield, *Tom Wedgwood, the First Photographer,* London, 1903, p. 189.

[7] *The Photographic News,* 16 Oct. 1885, p. 669.

[8] Eliza Meteyard, *A Group of Englishmen (1795–1815), being records of the younger Wedgwoods and their friends, embracing the history of the discovery of photography, and a facsimile of the first photograph,* London, 1871.

[9] F. J. B. Watson, 'George IV as an Art Collector', *Apollo,* London, June 1966.

[10] Dr Thomas Young, 'Experiments and calculations relative to physical optics', *Phil. Trans. Roy. Soc.* 1804, p. 15.

Part II THE INVENTION OF PHOTOGRAPHY

5 *Heliography*

[1] Pronounce Nee-epps.

[2] The correspondence of the Niépce brothers was published by Victor Fouque in *La Vérité sur l'invention de la photographie,* Paris, 1867. A total of 79 letters between Daguerre and Niépce are contained in *Documents of the History of Photography,* published in French and Russian by the Academy of Sciences, Moscow, 1949.

[3] This knowledge was probably based on Senebier's experiments with resins (see p. 37).

[4] Fouque, op. cit., p. 131.

[5] Ibid., p. 247, footnote.

[6] Isidore Niépce, *Historique de la Découverte improprement nommée Daguerréotype,* Paris, 1841, p. 17.

[7] Georges Besson, *La Photographie française*, Paris, 1936; Professor Erich Stenger, *Siegeszug der Photographie,* Seebruck, 1950, p. 7.

[8] From a letter preserved at George Eastman House, Rochester, N.Y.

[9] Niépce's letter to Francis Bauer, 19 Nov. 1827, published by Robert Hunt in *Researches on Light,* 1854, p. 25.

[10] Hunt, op. cit., Niépce's letter of 30 Nov. 1827.

[11] *The Photographic Journal* (Section A), Jan. 1951 and May 1952. Also *Bulletin de la Société Française de Photographie,* Paris, May 1952.

[12] W. H. Wollaston, 'On a periscopic camera obscura and microscope', *Phil. Trans. Roy. Soc.,* July 1812.

[13] Wolfgang Schade, '100 Jahre Photographie?', *Illustrierter Beobachter,* Berlin, 1937, p. 1804.

[14] Niépce de Saint-Victor, 'Note sur un nouveau vernis héliographique pour la gravure sur acier', *Comptes Rendus de l'Académie des Sciences,* 30 Oct. 1853.

[15] Ibid., 8 Oct. 1855.

[16] The iris diaphragm (for a telescope) seems to have been first suggested and described by William Nicholson in his *Journal of Natural Philosophy,* vol. i, London, 1797, p. 180.

6 *The Daguerreotype*

[1] *Biographies des Hommes du Jour,* Paris, 1841. Article by Gustave Deville.

[2] Dioramas were also opened in Breslau (1826), Berlin (1827), and Stockholm (1846), but only in Paris and London were the tableaux by Daguerre and Bouton themselves. The Diorama at Park Square East delighted Londoners until 1851, when the rival attractions of five other Dioramas in London, and the Great Exhibition at the Crystal Palace, seem to have proved too much for it. The building re-opened its doors to the public in 1855–as a Baptist chapel.

[3] *The Illustrated London News,* 26 July 1851.

[4] Mayer and Pierson, *La Photographie considérée comme Art et comme Industrie,* Paris, 1862.

[5] *Journal des Artistes,* Paris, 27 Sept. 1835.

[6] *The Literary Gazette,* London, 2 Mar. 1839.

[7] *Œuvres complètes de François Arago,* ed. by J. A. Barral, Paris and Leipzig, 1854–62, vol. xii.

[8] A. Mentienne, *La Découverte de la photographie en 1839,* Paris, 1892, pp. 16, 137.

[9] *Les Familles de France, les hommes d'état, de guerre, de science et d'art,* Paris, 1851.

[10] It was not until Aug. 1841, when State pensions had long been settled on Daguerre and Niépce, that Isidore, finding the glory too much concentrated on his partner, gave vent to his feelings in a polemical brochure *Historique de la Découverte improprement nommée Daguérreotype.*

[11] Niépce's exposure was reported to be longer in every speech, until on 19 Aug. it was said to be three days! Daguerre's on the other hand became shorter and shorter!

[12] Ludwig Pfau, *Kunst und Gewerbe,* part i, Stuttgart, 1877, pp. 115–17.

[13] A bibliography of all editions of Daguerre's manual compiled by Beaumont Newhall is contained in *L. J. M. Daguerre* by Helmut and Alison Gernsheim, London, 1956.

[14] On 11 Nov. 1839 Cauche exhibited to the Académie des Sciences a prism lens by means of which the image was not laterally transposed, thus overcoming one of the initial drawbacks of the daguerreotype.

[15] The first poem inspired by photography (1839) by Dr J. P. Simon, a Frenchman residing in London.

[16] On a copy of the marriage certificate at George Eastman House, Rochester, N.Y., Mme Daguerre's maiden name is given as 'Louise Georgina Smith'. On her tombstone it is recorded as 'Arrowsmith'.

7 Negative/positive processes on paper

[1] W. H. Fox Talbot, *The Pencil of Nature,* part i, London, 1844.

[2] Harold White, *The Photographic Journal* (Section A), Nov. 1949, p. 250.

[3] According to *The Pencil of Nature,* part i, the exposure lasted half an hour, but in his paper to the Royal Society, 31 Jan. 1839, Talbot says ten minutes. In his text to plate xv of *The Pencil of Nature*–a view of Lacock Abbey–Talbot explains, 'the shortest time of making them was nine to ten minutes'.

[4] *Journal of the Society of Arts,* May 1853, p. 292.

[5] *The Literary Gazette,* 13 Apr. 1839, p. 235. It is strange that Talbot and his many scientific friends should have overlooked a report, reprinted from the *Gazette de France,* in the same paper on 12 Jan. 1839, p. 28, stating that Daguerre used copper plates, not paper.

[6] *The Literary Gazette,* 2 Feb. 1839, p. 72.

[7] Published in *The Athenaeum,* 9 Feb. 1839; and *London and Edinburgh Philosophical Magazine,* vol. xiv, May 1839.

[8] Talbot's friendship with the eminent Scottish scientist dates from 1831.

[9] *The Literary Gazette,* 13 Apr. 1839, p. 235.

[10] *Comptes Rendus,* vol. viii, 1839, p. 838.

[11] Helmut Gernsheim, 'Talbot's and Herschel's Photographic Experiments in 1839', *Image,* no. 3, Rochester, N.Y., Sept. 1959.

[12] 'The world's first photographic manual, and the English editions of Daguerre's manual', by Helmut Gernsheim: *The Photographic Journal* (Section A), Sept. 1950.

[13] C. H. Talbot, *The Photographic News,* 1889, pp. 238–9. Actually the number must have been much greater, for thirty photographs of that period were in the Herschel sale at Sotheby's, March 1958.

[14] Gaston Tissandier, *A History and Handbook of Photography,* 2nd ed., London, 1878, Appendix A, by Fox Talbot.

[15] Talbot's statements about exposure times must be taken with a grain of salt. All calotypists mention exposures of several minutes. Hill and Adamson, the leading portraitists in the calotype period, never took a portrait in 'moderate daylight' but always in sunshine; this was not from choice but from necessity.

[16] For this unpublished letter we are indebted to Harold White.

[17] *The Athenaeum,* 17 July 1841; *The Philosophical Magazine,* vol. xix, 1841, p. 164; *Proc. Roy. Soc.,* vol. vi, 1841.

[18] This fact was acknowledged by Talbot in a notebook entry in April 1839 which reads: 'Dilute gallic acid and dilute nit. silver mixed turn dark in daylight [I believe Mr Reade discovered this].'

8 Direct positives on paper

[1] MS. in the possession of the Société Française de Photographie.

[2] *La Lumiére,* 2 Sept. 1854.

[3] According to *Bohemia–ein Unterhaltungsblatt,* Prague, 17 Dec. 1839, Bayard worked with a lens of 18 in. focal length and took 6 in.× 8 in. pictures.

[4] Much of the report, which was published in full in the Paris *Moniteur* on 13 Nov. 1839, was reprinted in *Le Technologiste,* vol. i, Paris, Jan. 1840, p. 159.

[5] Previous to Herschel's announcement of hypo, Bayard had fixed with potassium bromide.

[6] *Comptes Rendus,* vol. x, 1840, p. 337.

[7] *Comptes Rendus,* vol. viii, 8 Apr. 1839, p. 547.

[8] Ibid., vol. x, 1840, p. 478.

[9] *The Edinburgh New Philosophical Journal,* vol. xvii, July 1839.

[10] Collection of the Société Française de Photographie; reproduced by Lo Duca in *Bayard,* Paris, 1943.

[11] Op. cit.

9 *Other independent inventors*

[1] A list of such claims was compiled by Pierre Harmant and published under the title 'Anno 1839' in *Camera,* Lucerne, Apr. and June 1960.

[2] Full text published by Professor Erich Stenger in *Die Beginnende Photographie im Spiegel von Tageszeitungen,* Würzburg, 1943.

[3] *Allgemeine Schweizer-Zeitung,* 9 Feb. 1839.

[4] Dr Thomas Young did nothing of the kind, as we have seen, and Niépce, though achieving direct positive photographs on metal and glass, failed where Gerber seems to have succeeded, namely in producing a number of copies from a paper negative.

[5] F. Gerber, *Handbuch der allgemeinen Anatomie,* Berne, Chur, and Leipzig, 1840, p. 1.

[6] Ibbetson's letter to the *Journal of the Society of Arts,* Jan. 1852, p. 69.

[7] Henry H. Snelling, *The History and Practice of the Art of Photography,* 3rd ed., New York, 1851.

[8] *The Photographic Journal,* London, Jan. 1961.

[9] Letter to Lyndon Smith of 16 Dec. 1859 published in *The British Journal of Photography,* 1 Mar. 1862.

[10] Reade's letter was published by Robert Hunt in *The Philosophical Magazine,* May 1854.

[11] Thomas and Richard Willats, *Plain Directions for obtaining Photographic Pictures by the Calotype, Energiatype, and other Processes on paper,* 2nd enlarged ed., London, 1845.

[12] Robert Hunt, *Researches on Light,* 2nd ed., London, 1854, p. 85.

[13] Letter from J. B. Reade in *The British Journal of Photography,* 1 Mar. 1862.

[14] In the form of pyrogallol it has remained an important developing agent ever since.

[15] Letter from J. B. Reade, *The Photographic Journal,* 16 Mar. 1868, p. 16.

[16] *The North British Review,* vol. vii, no. xiv, Edinburgh, Aug. 1847.

[17] The full text of the letter was published in *The Photographic Journal,* vol. ii, 1 July 1854; *Notes & Queries,* 8 July 1854; *The Art Journal,* Aug. 1854.

[18] Published in *Gelehrte Anzeigen der Königlichen Bayrischen Akademie der Wissenschaften,* 3 July 1839.

[19] Rudolf Loher, *Carl August von Steinheil, der Erfinder und Schöpfer der Kleinbild-Photographie vor 100 Jahren,* Munich, n.d. [1937]; Erich Stenger, *Die Photographie in München 1839–1860,* Berlin, 1939, also in *Siegeszug der Photographie,* Seebruck, 1950, p. 112.

[20] Helmut and Alison Gernsheim, 'Die ersten Deutschen Photographen', *Foto-Prisma,* Düsseldorf, Dec. 1959, and *Image,* Rochester, N.Y., March 1960.

[21] Newspaper report cited by Wilhelm Dost and Erich Stenger in *Die Daguerreotypie in Berlin,* Berlin, 1922, p. 18.

[22] *The Edinburgh Philosophical Journal,* vol. i, 8 Jan. 1819.

[23] Letter from Herschel to Alfred Brothers quoted in *British Journal of Photography,* 17 June 1887.

[24] This and other documents were first published in 'Talbot's and Herschel's Photographic Experiments in 1839' by Helmut Gernsheim, *Image,* no. 3, Rochester, N.Y., Sept. 1959.

[25] *Proc. Roy. Soc.,* vol. iv, 1839, p. 131; *The Philosophical Magazine,* vol. xiv, p. 365.

[26] Hyposulphite of soda is actually a misnomer. The substance which is used for fixing photographs is sodium thiosulphate. In July 1869 M. P. Schutzenberger communicated a paper to the Académie des Sciences, Paris, 'On a new sulphur acid', in which it was shown that hyposulphite of soda was the correct name for the newly-discovered substance. The old acid had therefore to be renamed 'sodium thiosulphate', but the term 'hypo' had by then been so generally adopted that few photographers have ever heard its correct name.

[27] Op. cit. (see footnote 24).

[28] *Phil. Trans. Roy. Soc.,* 1840, pp. 1–59.

[29] The original is preserved at the Science Museum, London. The leather case containing it is embossed with the wrong date '10th February 1839' (the date of a paper photograph

of the telescope). Herschel wrote of it: 'Very precious; the last remaining record of an old fact photographically registered in the earliest infancy of the photographic art, taken some time in 1839–between September 9 and the end of the month. See Experiment 1075, Chemical Expts. vol. iii, p. 399.' The description there is entered under 9 Sept. 1839 and quoted by Professor Alexander Herschel in *The Photographic Journal,* June 1872.

[30] *The Photographic Journal,* June 1872.

[31] Full text published by Helmut Gernsheim, op. cit. (see footnote 24).

Part III THE EARLY YEARS OF PHOTOGRAPHY

10 *The daguerreotype in France*

[1] *The Athenaeum,* London, 21 December 1839.

[2] *La Lumière,* Paris, 29 July 1854 and 10 February 1855.

[3] *Comptes rendus,* 19 August 1839, p. 266 (footnote).

[4] M. A. Gaudin, *Traité pratique de Photographie,* Paris, 1844.

[5] The coating of the daguerreotype was comparatively insensitive to colours other than blue and violet.

[6] *Comptes rendus,* 14 Oct. 1839, p. 485.

[7] *Spenersche Zeitung,* Berlin, 22 Oct. 1839. The reference there to an earlier portrait made by Daguerre is incorrect.

[8] François Gouraud, *Description of the Daguerreotype Process,* Boston, (Apr.) 1840.

[9] J. F. Soleil. *Guide de l'Amateur de Photographie,* Paris, (May) 1840.

[10] N. P. Lerebours, *Derniers Perfectionnements apportés au Daguerréotype,* 2nd ed., Paris, May 1842.

[11] N. P. Lerebours, *Traité de Photographie,* Paris, 1843, p. 70.

[12] *The Woman at Home,* London, vol. viii, 1897, p. 812.

[13] M. A. Gaudin and N. P. Lerebours, *Derniers Perfectionnements apportés au Daguerréotype,* Paris, November 1841, p. 43.

[14] M. A. Gaudin, *Traité Pratique de Photographie,* Paris, 1844, p. 156.

[15] N. P. Lerebours, *Traité de Photographie,* Paris, 1843.

[16] Abbé Moigno, *Répertoire d'Optique moderne,* Paris, 1847.

[17] *La Lumière,* Paris, 8 October 1851.

[18] Baron Gros, *Quelques Notes sur la Photographie,* Paris, (Jan.) 1850.

11 *The daguerreotype in America*

[1] *The Observer,* New York, 20 April 1839.

[2] Seager's letter of 7 November 1839 to the American Institute was published in *Image,* Rochester, N.Y., Jan. 1952.

[3] *A Full Description of the Daguerreotype Process: as published by M. Daguerre,* ed. Prof. J. J. Mapes, New York, (Mar.) 1840.

[4] Marcus A. Root, *The Camera and the Pencil,* Philadelphia, 1864.

[5] Letter from Draper to the New York Mechanics' Institute, reprinted in Root, op. cit.

[6] *The United States Gazette,* Philadelphia, 24 Oct. 1839.

[7] *The Knickerbocker,* New York, vol. xiv, 1839, p. 560.

[8] *Evening Star,* New York, 21 Feb. 1840.

[9] Ibid., 24 Feb. 1840.

[10] Reprinted by Beaumont Newhall in *Image,* no. 1, Rochester, N.Y., Mar. 1960.

[11] Dr Andrew Fyfe, 'On Photography', *The Edinburgh New Philosophical Journal,* July 1839, p. 150. This paper was reprinted in a number of English journals.

[12] *The Sun,* New York, 4 Mar. 1840.

[13] Article by John Johnson in *Eureka,* vol. i, New York, 1846, p. 25.

[14] *Journal of the Society of Arts,* London, 18 Aug. 1882, p. 932. By a slip, the date is given as 'April 1839' instead of 1840.

[15] J. W. Draper, 'On the process of Daguerreotype, and its application to taking Portraits from the Life', *Philosophical Magazine,* vol. xvii, Sept. 1840.

[16] Fortunately the daguerreotype was photographed in 1933 before the image disappeared, no doubt through an unskilful attempt to clean it.

[17] The only other portraits Herschel could have seen were the experimental ones taken in Paris.

[18] *Philosophical Magazine,* Feb. 1843. This rare historical item, which measures about 3½ in. × 3 in. and is in perfect condition, is preserved at the Science Museum, London.

[19] Advertisement in the *Scientific American,* 11 Sept. 1845.

[20] *Memoires of John Quincy Adams,* Philadelphia, 1876.

[21] Francis Wey, 'Comment le soleil est devenu peintre', *Musée des Familles,* Paris, June–July 1853.

[22] L. W. Sipley, *The Pennsylvania Arts and Sciences,* Philadelphia, 1937.

[23] John Werge, *The Evolution of Photography,* London, 1890, p. 143.

[24] Robert Taft, *Photography and the American Scene,* New York, 1938, p. 253.

[25] *The Photographic Art Journal,* vol. viii, New York, 1855, p. 124.

[26] *The Art Journal,* London, Nov. 1850.

[27] Taft, op. cit.

[28] *The Art Journal,* London, Mar. 1854.

12 *The daguerreotype in Great Britain*

[1] Lawsuit *Beard* v. *Egerton,* 27 May 1846, as reported in *Court of Common Pleas,* vol. iii, London, 1848.

[2] Preamble to the patent. It is not known who were the persons who opposed the patent.

[3] *The Athenaeum,* 26 Oct. 1839, p. 813.

[4] Lawsuit *Beard* v. *Egerton,* 2 June 1845, as reported in *The Times,* 3 June.

[5] *The Spectator,* 2 Feb. 1839, p. 115.

[6] Georges Potonniée, *The Photographic Journal,* Jan. 1938, p. 33.

[7] Ibid., p. 35.

[8] 158 whole-plate daguerreotypes by Dr Ellis are preserved at the Science Museum, London.

[9] Rev. Dr Alexander Keith, *Evidence of the Truth of the Christian Religion,* 36th ed., Edinburgh, 1848.

[10] *The Athenaeum,* 14 Sept. 1839. Advertisement.

[11] For bibliography see 'The world's first photographic manual, and the English editions of Daguerre's manual', by Helmut Gernsheim, *The Photographic Journal* (Section A), Sept. 1950; and *L. J. M. Daguerre.*

[12] *London Saturday Journal,* 2 Nov. 1839.

[13] *The British Journal of Photography,* 21 Feb. 1868, p. 90.

[14] *The Athenaeum,* 18 Apr. 1840, and *Fraser's Advertiser,* 1840, p. 1979. Advertisement.

[15] *The Art Union*, Apr. 1841. Advertisement.

[16] Some had a Lerebours plano-convex lens working at F. 17.

[17] *The Photographic News,* 21 Aug. 1868.

[18] As there are several claimants for the honour of having first observed the superior sensitivity of silver bromide, we should mention that priority in every respect, including that of publication, belongs to Fox Talbot. A communication on the subject from Talbot was read to the Académie des Sciences on 18 Mar. 1839 and to the Royal Society three days later. Sir John Herschel confirmed Talbot's observation in his communication to the Royal Society on 20 Feb. 1840, when he stated that a glass plate coated with bromide of silver plus nitrate of silver is far more rapid than when coated with iodide of silver.

[19] The site of Furnival's Inn is now occupied by the Prudential Assurance Co.

[20] Quoted in *The Photographic News,* 13 May 1864.

[21] J. F. Goddard, *The Chemist,* vol. ii, May 1841, p. 143.

[22] Francis S. Beatty, *The Year-book of Photography and Photographic News Almanac for 1884,* p. 77.

[23] Ibid.

[24] *Intelligenzblatt der Stadt Bern,* 10 Nov. 1841. Quoted in Professor Erich Stenger's *Die Beginnende Photographie,* Würzburg, 1943, p. 15. The reporter was probably mistaken in referring to Wolcott as the operator.

[25] *George Cruikshank's Omnibus,* 1842, pp. 29–32.

[26] Francis S. Beatty, op. cit. (see footnote 22).

[27] Gaudin and N. P. Lerebours, *Derniers Perfectionnements apportés au Daguerréotype,* Paris, Nov. 1841, p. 43.

[28] [Jabez Hogg], *Photography Made Easy,* London, 1845.

[29] A. Claudet, *The British Journal of Photography,* 21 Feb. 1868, p. 90.

[30] *The Athenaeum,* 17 July 1841; also *The Philosophical Magazine,* vol. xix, p. 167.

[31] Letter from Claudet in *The Spectator,* 11 Sept. 1841.

[32] Better known subsequently as Gatti's Restaurant, it became the Nuffield Centre in July 1948.

[33] 'Reminiscences of an old photographer', by Thomas Sutton, *The British Journal of Photography,* 30 Aug. 1867, p. 413.

[34] *The Athenaeum,* 26 June 1841. Advertisement.

[35] *The Spectator,* 4 Sept. 1841.

[36] *The Illustrated London News,* 27 May 1843. Advertisement.

[37] *The Athenaeum,* 14 Aug. 1841. Advertisement. The 'new application' can only have been Fizeau's treatment with chloride of gold, though it is strange that a year passed before Claudet availed himself of it.

[38] J. F. Goddard, *The Polytechnic Journal,* vol. iv, 1841, p. 248.

[39] *The Illustrated London News,* 23 July 1842. Advertisement.

[40] *The Liverpool Mercury,* 10 Sept. 1841.

[41] Francis S. Beatty, *The Photographic News,* 8 Aug. 1879.

[42] *The Times,* London, 22 Dec. 1961.

[43] *The Photographic News,* 1886, p. 370.

[44] *The Manchester Guardian,* 29 June 1850.

[45] [Jabez Hogg] *Photography Made Easy,* London, 1845.

[46] *Münchner Morgenblatt,* 16 Apr. 1842.

[47] A pupil of Isabey and author of *Lettres sur la miniature,* Paris, 1823. Also English edition, 1823.

[48] *The Athenaeum,* May 1847, p. 472.

[49] *The Illustrated London News,* 27 May 1843. Advertisement.

[50] *The Spectator,* 4 Sept. 1841.

[51] *La Lumière,* 23 Mar. 1851.

[52] *The Art Union,* Oct. 1845 and Apr. 1846. Advertisement.

[53] Dr Andrew Winter [Wynter], *The People's Journal,* vol. ii, 1846, p. 288.

[54] *The Manchester Guardian,* 29 June 1850.

[55] *The North British Review,* Aug. 1847, pp. 465 et seq.

[56] *The Photographic Journal,* Apr. 1855, p. 158.

[57] *The Athenaeum,* 30 Aug. 1856.

[58] One in the Gernsheim Collection is dated as late as 1858.

[59] *The Art Journal,* Oct. 1849, p. 294.

[60] Mayall's brochure entitled *Daguerreotype Institution,* 433 West Strand, London, 1848.

[61] *The Athenaeum,* 17 Apr. 1847.

[62] *The Photographic News,* 16 Aug. 1861, p. 383.

[63] *The Athenaeum,* 10 Apr. 1847. Advertisement.

[64] L. Tennant Woods, *The British Journal of Photography,* 13 Feb. 1920, and others.

[65] 'Cuthbert Bede' (Rev. Edward Bradley), *Photographic Pleasures,* London, 1855, pp. 29–31.

[66] J. B. Dancer, 'Early Photography in Liverpool and Manchester', letter in *The Manchester Guardian,* 19 May 1886.

[67] *The British Journal of Photography,* 22 Aug. 1879, p. 400.

[68] Ibid.

[69] *The Photographic News,* 1884, p. 186.

13 The daguerreotype in German-speaking countries

[1] Wolfgang Baier, 'Die ersten Daguerreotypisten in Mecklenburg', *Bild und Ton,* no. 2, Halle, 1964.

[2] In most countries silvered copper plates could be bought ready-made.

[3] F-n, *Das Geheimnis der Daguerreotypie, oder die Kunst, Lichtbilder durch die Camera Obscura zu erzeugen,* Leipzig and Graz, (July) 1839. F. A. W. Netto, *Vollständige Anweisung zur*

Verfertigung Daguerre'scher Lichtbilder auf Papier, Malertuch & Metallplatten, Halle, (Aug.) 1839.

[4] *Münchner Politische Zeitung*, 31 Dec. 1839.

[5] *Spenersche Zeitung*, Berlin, 29 Apr. 1840.

[6] *Anweisung zum Gebrauche des neuen Daguerreotyp-Apparates zum Portraitieren, nach der Berechnung des Herrn Prof. Petzval, ausgeführt von Voigtländer und Sohn*, Vienna, (Jan.) 1841.

[7] *Wiener Zeitung*, 19 Jan. 1841.

[8] *Spenersche Zeitung*, 2 Mar. 1841.

[9] *Wiener Zeitung*, 24 Mar. 1841.

[10] J. M. Eder, *Geschichte der Photographie*, Halle, 1932; also *Allgemeine Photographische Zeitung*, Vienna, 1959.

[11] *Münchener Tagblatt*, 21 Oct. 1841.

[12] Advertisement in *Vossische Zeitung*, Berlin, 4 Feb. 1843.

[13] *Der Daguerreotypen-Krieg in Hamburg oder Saphir der Humorist, und Biow der Daguerreotypist vor dem Richterstuhl des Momus. Ein humoristisches Bulletin von 'Cephir'*, Hamburg, 1843.

[14] *Die Männer des deutschen Volks, besonders nach Biows Lichtbildern auf Stein gezeichnet, oder Deutsche National-Galerie*, Frankfurt, 1849.

[15] *Praktische Anweisung zum Daguerreotypieren*, Leipzig, 1842; and Max Dauthendey, *Der Geist meines Vaters*, Munich, 1912.

[16] *Correspondent*, Munich, 28 July 1841.

[17] Bjørn Ochsner, *Fotografier af H. C. Andersen*, Copenhagen, 1960.

14 *The calotype and other paper processes in Great Britain*

[1] *The Photographic News*, 15 Feb. 1861.

[2] Roger Fenton, *The Photographic Journal*, vol. i, 3 Mar. 1853.

[3] *The Art Journal*, June 1852, p. 193.

[4] *The Polytechnic Journal*, vol. i, London, Oct. 1839.

[5] *Proceedings of the London Electrical Society*, Sessions 1841-3, vol. i, p. 49.

[6] *The Chemist*, Apr. 1842, p. 122.

[7] *The British Journal of Photography*, 2 Sept. 1864, and *The Photographic Journal*, 15 June 1865. The lens is preserved at the Science Museum, London.

[8] *The Photographic Journal*, Apr. 1854, p. 200.

[9] *The Photographic Journal*, 15 June 1865, p. 85.

[10] *The Edinburgh Review*, vol. lxxvi, Jan. 1843, pp. 309 et seq.

[11] Great Exhibition: Reports of the Juries, 1852, p. 276.

[12] *The Photographic Journal*, vol. ii, Dec. 1854, p. 89.

[13] D. B. Thomas, *The First Negatives* (Science Museum monograph), London, 1964.

[14] *The Art Union*, Aug. 1844. Advertisement.

[15] *The Art Journal*, Sept. 1859.

[16] 'Some common misconceptions about early photography in Scotland', by Helmut Gernsheim, *Functional Photography*, Nov. 1952.

[17] D. B. Thomas, op. cit. (see footnote 13).

[18] *The Liverpool and Manchester Photographic Journal*, 1859, p. 244.

[19] *The Edinburgh Review*, vol. lxxvi, Jan. 1843.

[20] Heinrich Schwarz claimed 3 to 6 minutes in his monograph, but this exposure is ruled out by virtue of some of Hill's subjects, such as 'Stonemasons at work', groups of fishwives and sailors at Newhaven, and Highlanders at Edinburgh Castle.

[21] *The North British Review*, vol. vii, Aug. 1847; article on photography.

[22] The painting hangs in the Presbytery Hall, The Mound, Edinburgh.

[23] Verlag der Roschütz'schen Buchhandlung (P. Fagot), Aachen, 1841.

[24] A complete set of this private publication is at the British Museum. The dates of receipt are indicated by date-stamps, and further corroborated by *The British Journal of Photography*, 25 Oct. and 29 Nov. 1889.

[25] *The British Journal of Photography*, 24 Aug. 1900.

[26] Professor Erich Stenger, *Photo Magazin*, June 1952, p. 50.

[27] The title was not original—it headed a review of the daguerreotype process in *The Literary Gazette*, Feb. 1839.

[28] Talbot's letter dated 23 June 1844 is in the Gernsheim Collection.

[29] Part i was illustrated with 5 plates and cost 12*s*., Part ii contains 7 plates and was sold at 21*s*., Parts iii–vi each contain 3 plates and cost 7*s*. 6*d*., so that the complete work of 24 plates came to 3 guineas. The size of the photographs is 6 in. × 8 in.

[30] *The Photographic Journal,* vol. vii, 15 Nov. 1860, p. 33.

[31] Information received from Harold White.

[32] Robert Hunt, *The Art Union,* 1848, p. 238.

[33] T. A. Malone, *The Liverpool and Manchester Photographic Journal,* 1857, p. 270.

[34] *Punch,* vol. xii, 1847, p. 143.

[35] *The Almanack of the Fine Arts for 1852,* London, 1851, p. 155.

[36] *Catalogue to the International Photographic Exhibition at the Crystal Palace,* 1898, p. 122.

[37] *Journal of the Society of Arts,* London, 31 Dec. 1852.

[38] *Pennsylvania Arts and Sciences,* vol. iv, no. 1, Philadelphia, 1937.

[39] Unsigned article, probably by Robert Hunt, in *The Imperial Journal of Art, Science, Mechanics and Engineering,* vol. i, Manchester, 1852, p. 544.

[40] *The Illustrated London News,* 28 Aug. 1852.

[41] This figure no doubt includes the cost of the Reading and Regent Street establishments, *The Pencil of Nature* and other ventures which Talbot had hoped would show a profitable return.

[42] Talbot's reply was published, together with the appeal, in *The Times* on 13 Aug. 1852.

[43] *The Imperial Journal of Art, Science, Mechanics and Engineering,* 1853, p. 57.

[44] *The Art Journal,* Sept. 1852.

[45] *The Journal of the Photographic Society of Bombay,* No. 1, 1855; reprinted in *Notes and Queries,* 21 Apr. 1855.

[46] Georges Potonniée, *Histoire de la découverte de la photographie,* Paris, 1925, p. 204.

[47] *Bulletin de la Société Française de Photographie,* May 1855.

[48] Frank Ludwig Neher, *Die Erfindung der Photographie,* Stuttgart, 1938.

15 Photography on paper in other countries

[1] *Die Daguerreotypie in Hamburg,* by Professor Wilhelm Weimar, Hamburg, 1915.

[2] *The Art Journal,* London, July 1849.

[3] *Berliner Gewerbe- Industrie- & Handelsblatt,* 10 Nov. 1847.

[4] According to information received from Beaumont Newhall, the calotype was patented in France by Moses Poole of London for the duration of ten years under Brevet d'Importation No. 10627.

[5] *Comptes Rendus de l'Académie des Sciences,* 27 May 1850.

[6] E. de Valicourt, *Nouveau Manuel complet de photographie sur metal, sur papier et sur verre,* Paris, 1851, p. 257.

[7] Blanquart-Evrard, *Comptes Rendus,* 8 Apr. 1851, p. 555. This claim was made prior to the foundation of the Lille printing establishment.

[8] *The British Journal of Photography,* 1872, p. 308.

[9] Maxime Du Camp, *Égypte, Nubie, Palestine et Syrie: Dessins photographiques recueillis pendant les années 1849, 1850 et 1851,* Paris, 1852. An English edition was published by E. Gambart, London, 1852, with French text but title-page and list of plates in English. The book appeared in 25 weekly parts each containing five plates.

[10] *The Art Journal,* 1852, p. 159.

[11] 'Note sur un nouveau mode de préparation du papier photographique négatif', *Comptes Rendus de l'Académie des Sciences,* vol. xxxiii, Paris, 8 Dec. 1851.

[12] A. Belloc, *Compendium des Quatres Branches de la Photographie,* Paris, 1858.

[13] The majority of the 104 photographs in *Paris tel qu'il fut* by Louis Cheronnet, Paris, 1951, were taken by Marville.

[14] Quoted in *La Lumière,* 24 Apr. 1852.

[15] *Le Midi de la France, sites et monuments historiques photographiés par Charles Nègre, peintre,* (Goupil), Paris, 1854–5.

[16] *Jersey et les Îles de la Manche, Vers par Victor Hugo; Prose par Auguste Vacquerie, Charles Hugo et François Hugo; Photographies par Charles Hugo; Dessins par Victor Hugo,* Paris, 1853.

[17] *La Lumière,* 6 Aug. 1853, p. 126.

16 The introduction of photography on glass

[1] Robert Hunt, *A Popular Treatise on the Art of Photography,* Glasgow, 1841, p. 72. See also J. T. Towson, *Liverpool and Manchester Photographic Journal,* 1858, pp. 82 and 298.

[2] *Comptes Rendus de l'Académie des Sciences,* vol. xxv, 1847.

[3] 'Note sur la photographie sur verre', *Comptes Rendus,* vol. xxvi, 1848, p. 637.

[4] *The Athenaeum,* 6 Dec. 1851.

[5] The name had already been used in 1840 by F. A. W. Netto for his process of *cliché-verre* in his brochure *Die Glasdruckkunst oder Hyalotypie.*

[6] *Almanah Mednarodne Fotografije,* Ljubljana, 1953.

[7] 'Die Transparentlichtbilder auf Glas, erfunden den 18. April 1842', *Sitzungsberichte der Mathematisch-Naturwissenschaftlichen Klasse der Kaiserlichen Akademie der Wissenschaften,* Vienna, vol. vi, 1851, pp. 43–46.

[8] The first proposal for albumenizing paper was made by 'H.L.' in a communication to *The Athenaeum* on 11 May 1839, suggesting that paper be prepared by washing it over with white of egg and water before applying the nitrate of silver solution.

[9] *The Photographic Journal,* 15 Aug. 1862.

[10] *The Photogram,* vol. i, 1894, p. 159. The German title of the firm was 'Dresdner Albumin Papier Fabrik A.G.', Dresden.

[11] Charles Stanley Hervé, 'A Half Century in Photography', *The Practical Photographer,* Jan. 1893, p. 1.

[12] Frederick Scott Archer, 'Origin of the Collodion Process', *The Liverpool and Manchester Photographic Journal,* 15 June 1857.

[13] Frederick Scott Archer, 'On the use of collodion in photography', *The Chemist,* new series, vol. ii, Mar. 1851. The communication is dated 18 Feb.

[14] The second enlarged edition which followed in 1854 is only slightly less rare. Both editions were published with the author's imprint at his address.

[15] Disdéri, *Manuel opératoire de Photographie sur Collodion Instantanée,* Paris, 1853; also A. Bertsch, *Notice sur l'Emploi de Collodion Rapide,* Paris, 1852.

[16] Under the heading 'To all interested in the Advancement of Photography', the conditions of the competition were reprinted in full in the *Almanack of the Fine Arts for 1852,* London, 1851.

[17] Reported by Thomas Sutton in *The British Journal of Photography,* 1875, p. 4.

[18] *The British Journal of Photography,* 5 Feb. 1875, p. 65.

[19] An abbreviated English translation by Thomas Cousins appeared in London, Aug. 1850, published by T. and R. Willats.

[20] E. de Valicourt, *Manuel de photographie,* 1862, vol. ii, p. 120.

[21] Archer's manual, 2nd edition, 1854.

[22] *Notes and Queries,* 25 Dec. 1852, p. 612; John Werge, *The Evolution of Photography,* 1890, p. 65.

[23] *The Illustrated London News,* 17 May 1851.

[24] *The Photographic News,* 6 June 1862.

[25] *The Photographic Journal,* 1862, p. 149.

[26] *Notes and Queries,* loc. cit.

[27] First published by Hunt in *The Art Journal,* July 1851.

[28] *The Photographic Journal,* 21 July 1858, p. 261.

[29] *Notes and Queries,* loc. cit.

[30] P. H. Delamotte, *The Practice of Photography: a Manual for Students and Amateurs,* London, 1853. Title-page. Also *Notes and Queries,* 23 Apr. 1853, p. 420. Advertisement.

[31] *The British Journal of Photography,* 13 June 1930.

[32] *The Art Journal,* Aug. 1854.

[33] *The British Journal of Photography,* 14 Feb. 1902.

[34] *The Athenaeum,* 10 June 1854.

[35] *The Photographic Journal,* 27 June 1854.

[36] 'The Photographic Patent Right', *The Art Journal,* Feb. 1855.

[37] *The Art Journal,* Apr. 1855.

[38] *Punch,* 13 June 1857.

Part IV THE COLLODION PERIOD

17 The popularization of photography

[1] *The Photographic Journal,* vol. i, 1854, p. 210.
[2] *The Quarterly Review,* vol. ci, Apr. 1857.
[3] *The Photographic Journal,* 16 Mar. 1865, p. 16.

18 Portrait photography–a new industry

[1] *The Photographic News,* Aug. 1861, p. 370.
[2] Op. cit., 3 June 1859, p. 149.
[3] Op. cit., 20 May 1859, p. 125.
[4] Beaumont Newhall, 'Plastic Daguerreotype Cases', *Image,* Rochester, N.Y., Dec. 1955.
[5] *The Liverpool Photographic Journal,* 8 July 1854, p. 83, and *Photographic Notes,* 1859, p. 75.
[6] Marcus A. Root, *The Camera and the Pencil,* Philadelphia, 1864, p. 372.
[7] *The Photographic News,* 18 Oct. 1861, p. 500.
[8] Op. cit., 24 Sept. 1858, p. 32.
[9] Henry Mayhew, *London Labour and the London Poor,* vol. iii, 1861, pp. 206 et seq.
[10] *The Photographic News,* 30 June 1865, p. 312.
[11] *Punch,* Oct. 1863, p. 178.
[12] *The Photographic News,* 30 June 1865, p. 312.
[13] Op. cit., 31 Aug. 1866, p. 420.
[14] Ernest Lacan, *The British Journal of Photography,* 16 July 1860, p. 212.
[15] *The Photographic News,* 1861, p. 590.

19 'High art' photography

[1] *The Photographic Journal,* 21 Feb. 1857, p. 217. Attributed to Joseph Durham, A.R.A., a member of the Photographic Society.
[2] *The Photographic Journal,* London, 3 March 1853.
[2a] *The Art Journal,* Feb. 1856.
[3] Lake Price, *A Manual of Photographic Manipulation, treating of the Practice of the Art and its various applications to Nature,* London, 1858.
[4] *The Practical Photographer,* Mar. 1897, p. 91.
[5] *The Photographic Journal,* 21 April 1858.
[5a] Presented by his daughter to the Gernsheim Collection.
[6] *The Practical Photographer,* March 1897.
[7] Ibid.
[8] *The Photographic Journal,* 15 Dec. 1863.
[9] *The Year-Book of Photography,* 1881, p. 28.
[10] *The Photographic Art Journal,* London, no. 1, Mar. 1870.
[11] *The Art Journal,* Feb. 1868.
[12] *The Illustrated London News,* May 1865.
[13] Marie A. Belloc, 'The Art of Photography', *The Woman at Home,* vol. viii, 1897.
[14] *The Literary Gazette,* 30 Mar. 1839.
[15] A similar technique had been independently devised by F. A. W. Netto and published in his brochure *Die Glasdruckkunst oder Hyalotypie,* Quedlinburg and Leipzig, 1840.
[16] A complete set is in the Gernsheim Collection.
[17] A method is described in *The Photographic Journal,* 16 May 1868, p. 60.
[18] For a detailed account of the history of *cliché-verre* see the authors' article in *Konstrevy,* Stockholm, Dec. 1954.

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20 *Stereoscopic photography*

[1] Euclid, *Treatise on Optics,* Paris, 1577, Theorems 26, 27, and 28.

[2] Galen, *De usu partium corporis humani,* Lugduni, 1550, p. 593.

[3] Leonardo da Vinci, *Treatise on Painting,* translated by J. F. Rigaud, London, 1835, paragraph 348.

[4] G. B. della Porta, *De refractione optices parte,* Naples, 1593, book v, p. 132; book vi, pp. 143–5.

[5] François d'Aguillon, *Opticorum libri sex,* Antwerp, 1613, books i and ii.

[6] Chérubin d'Orléans, *La Vision parfaite,* Paris, 1677. The author perfected the binocular telescope (1671), invented the binocular microscope and illustrated and described the construction of several other instruments of binocular vision.

[7] *The Liverpool and Manchester Photographic Journal,* Jan. 1857.

[8] Charles Wheatstone, 'On some remarkable and hitherto unobserved phenomena of binocular vision', *Phil. Trans. Roy. Soc.,* June 1838.

[9] *The Photographic Journal,* Apr. 1854, p. 200.

[10] These were shown to the Photographic Society of London by John Spiller in Apr. 1873.

[11] W. B. Carpenter. Lecture reported in *The British Journal of Photography,* 1862, p. 122.

[12] *The Illustrated London News,* 24 Jan. 1852.

[13] The daguerreotype, but unfortunately not the ring itself, is in the Gernsheim Collection.

[14] *The Photographic News,* Sept. 1858.

[15] However, the reflecting stereoscope and large binocular pictures were still listed in Horne & Thornthwaite's catalogue in 1857. But at 10*s.* a pair they were, of course, not competitive with the small binocular pictures made for Brewster's stereoscope, costing 1*s.* to 1*s.* 6*d.*

[16] *The Philosophical Magazine,* June 1852. There Elliot stated that he constructed his simple viewer in 1839, one year *after* Wheatstone's communication to the Royal Society.

[17] Professor Erich Stenger, *Das Photo-Magazin,* May 1952.

[18] A. Claudet, 'Photography in its Relation to the Fine Arts', *The Photographic Journal,* vol. vi, 15 June 1860.

[19] Sir David Brewster, *The Stereoscope,* London, 1856, p. 195.

[20] C. Piazzi Smyth, *Teneriffe: an Astronomer's Experiment,* London, 1858. Illustrated with twenty stereoscopic photographs.

[21] *The Illustrated London News,* 3 July 1858. Advertisement.

[22] Sir David Brewster, *The Stereoscope,* p. 205.

[23] Sir David Brewster, *The Scientific Review,* 1 Aug. 1866.

[24] *The Photographic News Almanack for 1863,* p. 30.

[25] The original, patented on 8 July 1853, destroyed in the Second World War, is illustrated in *Proceedings of the Seventh International Congress of Photography,* Cambridge, 1929, p. 506. An improved model was patented by Dancer on 5 Sept. 1856.

[26] The Quinetoscope is described and illustrated in *La Lumière,* 30 July 1853, pp. 123, 127.

[27] *Photographic Notes,* 15 Sept. 1859.

[28] *The Photographic News,*, June 1868, p. 296.

[29] C. Piazzi Smyth, *A Poor Man's Photography at the Great Pyramid in the Year 1865,* London, 1870.

21 *Instantaneous photography*

[1] *La Lumière,* 17 June 1854.

[2] Valentine Blanchard, 'Instantaneous Photography Thirty Years Ago', *The Photographic Quarterly,* vol. ii, 1891, p. 147.

[3] *Comptes Rendus,* vol. xix, 1844, p. 1039.

[4] *The Liverpool Photographic Journal,* 1854, p. 144.

[5] The photograph exists in two sizes. In the Permanent Collection of the Royal Photographic Society is a print 7⅜ in. × 5⅝ in.; the Gernsheim Collection possesses a larger one 16½ in. × 12¾ in., possibly an enlargement made by re-photographing the picture on a larger plate.

[6] Louis Figuier, *La Photographie au Salon de 1859,* Paris, 1860.

[7] *La Lumière,* 7 Aug. 1852.

[8] *The British Journal of Photography,* Oct. 1864.

22 News photography

[1] A representative selection of early news photographs is illustrated in *Historic Events 1839–1939* by Helmut and Alison Gernsheim, London and New York, 1960.
[2] Ernest Lacan, *Esquisses photographiques,* Paris, 1856, pp. 155–67.
[3] *La Lumière,* 23 June 1855.
[4] Op. cit., 29 July 1855.
[5] A search was made at the War Office, Public Record Office, United Service Museum, and Imperial War Museum.
[6] This and the following quotations are taken from Fenton's letters to his family and publisher, in the Gernsheim Collection, which also possesses Fenton's own complete set of photographs.
[7] It can be inferred, from a photographic meeting in London in February 1886, that Felice Beato accepted authorship for all photographs.
[8] *La Lumière,* 10 Sept. 1859.
[9] *Gardner's Photographic Sketch Book of the War,* 2 vols, Washington, D.C., 1865.
[10] A detailed account of the complicated history of these various collections is contained in *Guide to the Special Collections of Prints and Photographs in the Library of Congress,* ed. Paul Vanderbilt, Washington, D.C., 1955.
[11] James D. Horan, *Mathew Brady, Historian with a Camera,* New York, 1955.
[12] Marshall Fishwick, *General Lee's Photographer: the Life and Work of Michael Miley,* University of North Carolina Press, 1955.
[13] *The Photographic History of the Civil War,* ed. Francis T. Miller and others, New York, 1911–12.

23 Landscape and architectural photography

[1] *The Photographic News,* 13 May 1859.
[2] The name is taken from the title of a poem by James Hogg (the 'Ettrick Shepherd'), Edinburgh, 1815.
[3] *The Irish Metropolitan Magazine,* vol. ii, 1858.
[4] Dr John Nicol, *The British Journal of Photography,* 25 Mar. 1887. Reminiscences of thirty years before.
[5] *The Photographic News,* 29 Oct. 1858.
[6] Op. cit., Feb. 1859.
[7] *The Photographic Journal,* 21 July 1855.
[8] *The Photographic News,* 24 Feb. 1860, p. 297.
[9] *Photographic Notes,* vol. i, 1856, p. 235.
[10] *The Photographic Journal,* 15 Dec. 1862, p. 184.
[11] *The Art Journal,* Nov. 1862.
[12] *Dettagli di altari, monumenti, scultura ecc. della Basilica di San Marco in Venezia,* Venice, 1878–86.
[13] *The Photographic Journal,* 21 June 1858, p. 229.
[14] *Egypt and Palestine photographed and described by Francis Frith,* 1858–9, vol. ii, notes to picture entitled 'Doum Palm, and Ruined Mosque near Philae'.
[15] Op. cit., vol. ii, notes to the last plate.
[16] *The Art Journal,* 1859, p. 71.
[17] Ibid., pp. 71–72.
[18] John Ruskin, *Deucalion,* London, 1875.
[19] *The Photographic News,* 23 Aug. 1861, p. 401.
[20] A selection of Adolphe Braun's photographs, in the possession of Braun et Cie, was published under the title *Le Point,* Paris, 1944.
[21] Samuel Bourne, 'Ten Weeks with the Camera in the Himalayas', *The British Journal of Photography,* 1 Feb. 1864.
[22] Samuel Bourne, 'Narrative of a Photographic Trip to Kashmir and Adjacent Districts', *The British Journal of Photography,* 1866 and 1867 (in instalments).
[23] Samuel Bourne, 'A Journey through the Higher Himalayas', *The British Journal of Photography,* 1869 and 1870 (in instalments).

[24] In fairness to Bourne's achievement it must be pointed out that all mountaineer-photographers from Whymper on who exceeded his record after 1880 worked with either hand- or miniature-cameras, using ready-made dry plates or films.

24 *The carte-de-visite period*

[1] *The Photographic Journal,* 15 Apr. 1862, p. 30. Also *The Year-Book of Photography for the Year 1881,* London, 1880, p. 29.

[2] *La Lumière,* Paris, 28 Oct. 1854.

[3] *The Practical Mechanic's Journal,* London, 1855, p. 76. Robert Taft, in *Photography and the American Scene,* New York, 1938, p. 140, states that the first cartes-de-visite in America were taken in the autumn of 1859.

[4] *Encyclopaedia Britannica,* 8th ed., 1859, article 'Photography'.

[5] *The Liverpool and Manchester Photographic Journal,* 1 Sept. 1857, p. 192.

[6] *The Photographic News,* 4 Oct. 1861, p. 478.

[7] *The Photographic News,* Aug. 1861, p. 370.

[8] The Hon. Eleanor Stanley, *Twenty years at Court, 1842–62,* ed. Mrs Stewart Erskine, London, 1916.

[9] Since it was impossible at that period to reproduce photographs in newspapers and magazines (except in the form of engraved copies), the demand could only be satisfied by the sale of actual photographs.

[10] *The Photographic News,* 5 Aug. 1864, p. 383.

[11] *Jane Welch Carlyle: a new selection of her letters* arranged by Trudy Bliss, London, 1949.

[12] *The Photographic News,* 19 Aug. 1859–reprinted from *La Lumière,* Paris.

[13] *Punch,* vol. xi, 1846, p. 250.

[14] *Good Words,* March 1869 (supplement). Article by Dr A. Wynter.

[15] *The Photographic News,* 1885, p. 136.

[16] Op. cit., 1868, p. 555.

[17] *The Photographic Journal,* 15 Mar. 1862.

[18] 'To Charlotte with Her Photograph', by Percival Leigh, *Punch,* 26 Apr. 1862.

[19] *The Photographic News,* 1861, p. 180.

[20] According to *The Photogram,* 1903, p. 374, the picture postcard circulation in Germany was 400 million p.a., in France 88 million, and in England only 14 million during the same period.

[21] *The British Journal of Photography,* 1 Dec. 1860, p. 352.

[22] *The British Journal of Photography,* 1 Nov. 1860, p. 317.

[23] Like many other photographic terms, 'Cabinet' was borrowed from painting, where it applied to small Old Master pictures which from their size and value were preserved in a cabinet or small room.

[24] *The Photographic News,* 8 Aug. 1862.

[25] *The British Journal of Photography,* 14 Jan. 1886, p. 18.

25 *Some famous portrait photographers*

[1] Letter to William Michael Rossetti, dated 23 Jan. 1866, in the Gernsheim Collection.

[2] William Gaunt called Mrs Cameron 'the Watts of photography', adding 'There are those who would call her the better portraitist of the two'.

[3] Quoted in *The Woman at Home,* vol. 8, 1897, p. 582.

[4] Now in the Cabinet des Estampes at the Bibliothèque Nationale.

[5] *The Photographic Journal,* 15 Oct. 1867, p. 128.

[6] 'A Photographer's Day Out', *The South Shields Amateur Magazine,* 1860.

[7] Helmut Gernsheim, *Lewis Carroll, Photographer,* London and New York, 1949.

[8] James D. Horan, *Mathew Brady, Historian with a Camera,* New York, 1955; Roy Meredith, *Mr. Lincoln's Camera Man,* New York, 1946, and *Mr. Lincoln's Contemporaries,* New York, 1951.

[9] 'American Photography a Century Ago', *The British Journal of Photography*, 16 Nov. 1951.
[10] Robert Taft, *Photography and the American Scene*, New York, 1938, p. 195.
[11] James D. Horan, op. cit.

26 *Mammoth and miniature photographs*

[1] Beaumont Newhall, *Modern Photography*, June 1953.
[2] *The Photographic Journal*, 16 June 1862, p. 67.
[3] Also in *The Photographic Journal*, 22 Aug. 1853, p. 101.
[4] A detailed description of the solar camera appeared in *Photographic Notes*, vol. iv, 1859, p. 176.
[5] *The Liverpool and Manchester Photographic Journal*, 1858, p. 297.
[6] *The Photographic News*, 1861, p. 331.
[7] A. Chevallier, *La méthode des portraits de grandeur naturelle et les agrandissements photographiques à la portée de tout le monde*, Paris, 1862.
[8] *The Photographic Journal*, 15 May 1865, p. 72.
[9] *The British Journal of Photography*, 1873, p. 617.
[10] Op. cit., 15 Nov. 1860, p. 339.
[11] *The Photographic News*, 18 Jan. 1861. (Kibble had retired from photography by the beginning of 1860.)
[12] The camera is illustrated in *Harmsworth Magazine*, vol. vi, London, 1901, pp. 317–21.
[13] *The British Journal of Photography*, 29 Mar. and 4 Oct. 1901.
[14] *The Photographic Journal*, 17 Dec. 1867, p. 155.
[15] Beaumont Newhall, *The History of Photography from 1839 to the Present Day*, New York, 1964, p. 80.
[16] Charles Gibson, *The Romance of Modern Photography*, London, 1908, p. 260.
[17] *The Athenaeum*, 9 July 1853.
[18] *Bulletin de la Société Française de Photographie*, vol. xxxiii, 1887, p. 60.
[18a] Ibid.
[19] *The Times*, 27 July 1950.
[20] *The Photographic News*, 13 May 1859, p. 117.
[21] Lady Ely's pendant with photograph size $\frac{1}{2}$ in. × $\frac{9}{16}$ in. is in the Gernsheim Collection. Lady Salisbury's is on view at Hatfield House.
[22] *The Photographic Journal*, 15 Jan. 1864, p. 440.
[22a] For method of production see *The British Journal of Photography*, 13 July 1900, p. 435.
[23] *The Photographic News*, 1884, p. 826.
[24] *The British Journal of Photography*, 1905, p. 22.
[25] De Lafollye, *Memoir of the Photographic and Administrative Section of the Service of Dispatching by Carrier Pigeons during the Siege of Paris 1870–71*, Feb. 1871. Privately published by George W. Angers, Springfield, Mass., 1952.
[26] Dagron published an account of his experiences and work in *Bulletin de la Société Française de Photographie*, vol. xvii, 1871, p. 20.
[27] *The Year-book of Photography for 1884*, p. 142.
[28] Gaston Tissandier, *History of Photography*, London, 1876, p. 244.
[29] For other interesting facts see 'The use of Microfilms in Library and Office', *The Times*, 27 July 1950.

27 *The evolution of dry plates*

[1] *The Photographic News*, 11 Jan. 1861.
[2] *The Liverpool and Manchester Photographic Journal*, 15 Feb. 1859. We thoroughly agree with the opinion after reading this paper, which occupies ten pages of the (London) *Photographic Journal*, Feb. 1859.
[3] *The Photographic News*, 18 Jan. 1861.
[4] *The Photographic News*, 8 Apr. 1859.
[5] *Nature*, 5 Feb. 1874, p. 263.
[6] *La Lumière*, 22 Apr. and 27 May 1854.
[7] *The Philosophical Magazine*, May 1854.
[8] *The Photographic Journal*, 21 July 1854.
[9] *Notes and Queries*, 17 June 1854.
[10] *The Photographic Journal*, 21 July 1854. Communication dated 6 July.

[11] The process was amusingly described by its 'inventor', James Mudd, in his manual *The Collodio-albumen Process,* London, 1866.

[12] However, Norris's dry plates were not the first to be sold in packets, for–on a much smaller scale–Negretti & Zambra of London sold packets of albumen plates from Jan. 1855 on, which were guaranteed for one month. The Norris plates, being collodion, were considerably faster, and combined with their extended period of sensitivity, were the first commercial dry plates to enjoy real popularity.

[13] Major C. Russell, *The Tannin Process,* London, n.d. [1861].

[14] *The British Journal of Photography,* 15 Nov. 1862.

[15] *The Photographic News,* 7 Nov. 1862.

[16] *The British Journal of Photography,* 9 and 16 Sept. 1864.

[17] The word 'emulsion' was introduced into photographic terminology by Sir John Herschel in his memoir to the Royal Society on 20 Feb. 1840.

[18] *The Photographic News,* 21 Sept. 1860.

[19] *The British Journal of Photography,* 16 Jan. 1874.

[20] *Comptes Rendus,* vol. xxv, p. 585.

[21] *The Photographic Journal,* 20 May 1854. The communication is signed 'E.R.'.

[22] A. Gaudin, 'Photogène à la Gélatine', *La Lumière,* 15 Apr. 1861. Reprinted in *The Photographic News,* 23 Aug. 1861.

[23] *Photographic Notes,* 1 June 1861.

[24] *The British Journal of Photography,* 14 July 1871.

[25] *The British Journal of Photography,* 8 Sept. 1871.

[26] *The British Journal of Photography,* 18 July 1873. Advertisement.

[27] *The British Journal of Photography,* 3 Oct. 1873.

[28] Op. cit., 25 July 1873.

[29] Op. cit., 15 Aug. 1873.

[30] The final amount of the testimonial was £700, but this was not reached until after Dr Maddox's death.

[31] *The Practical Photographer,* 1 Dec. 1891.

[32] *The British Journal of Photography,* 14 Nov. 1873.

[33] *Journal of the Society of Arts,* 17 Mar. 1882, p. 460.

[34] *The British Journal of Photography,* Apr. 1876 (advert.).

[35] John Werge, *The Evolution of Photography,* London, 1890, p. 97.

[36] *The British Journal of Photography,* 22 Aug. 1879, p. 403.

[37] Colonel Stuart-Wortley had in June 1876 communicated to the Photographic Society a paper on heating the emulsion to a temperature of 180° F., but this suggestion lacks any scientific significance since its purpose was merely to form the emulsion more quickly. In fact, Stuart-Wortley remarked that the high temperature, which was maintained for only a quarter of an hour, had no *injurious* effect on the gelatine!

[38] *Photography,* 1889, p. 172.

[39] H. W. Vogel, *Die Photographie farbiger Gegenstände in den richtigen Tonverhältnissen,* Berlin, 1885.

28 Permanent photographs

[1] Between 1855 and 1875 about 450 books illustrated with albumen-silver prints and priced at between one and twelve guineas were published in Great Britain. Several cost considerably more: one, *The Queen's Bible* (1862) illustrated with photographs by Francis Frith, cost as much as 50 guineas.

[2] W. J. Harrison, *History of Photography,* Bradford and London, 1888, p. 87.

[3] *The British Journal of Photography,* 28 June 1872, p. 309.

[4] Thomas Sutton, *A new method of printing positive photographs, by which permanent and artistic results may be uniformly obtained,* Jersey, July 1855.

[5] Sutton compiled the first dictionary of photography (1858) and invented several cameras and lenses.

[6] *Photographic Notes,* Feb. 1862.

[7] Op. cit., Jan. 1856.

[8] *The Photographic Journal,* Nov. 1855, p. 251.

[9] Not bichromate of *mercury* as stated in the the *Dictionary of National Biography.*

[10] Reprinted in the *Magazine of Science,* 6 July 1839.

[11] *The Scientific American,* 15 Apr. 1854.

[12] A. Poitevin, *Traité de l'impression photographique sans sels d'argent,* Paris, 1862, p. 173.

[13] *The Illustrated London News,* 22 Jan. 1859, p. 33.

[14] A number of Swan's earliest carbon prints made in 1864–5 were kindly presented to the Gernsheim Collection by his son, Sir Kenneth Swan.

[15] *The Photographic News,* 1868, p. 267.

[16] In 1893 the Autotype Company produced a carbon enlargement for the Chicago World Exhibition measuring 7 ft× 4½ ft. This was the largest carbon print ever made from a single negative and on one piece of paper.

[17] *The Photographic Journal,* 16 Mar. 1869, p. 4.

[18] Dr A. Wynter, *Peeps into the Human Hive,* London, 1874, p. 58.

[19] *The Photographic Journal,* 1866, p. 133.

[20] *The Photographic News,* 1868, p. 267.

[21] *The British Journal of Photography,* 16 Aug. 1872, p. 383.

[22] Advertisement in Gaston Tissandier's *History of Photography,* 2nd ed., London, 1878.

[23] H. Baden Pritchard, *The Photographic Studios of Europe,* London, 1882, p. 100.

[24] *The Liverpool and Manchester Photographic Journal,* 1857, p. 183.

[25] Op. cit., pp. 183 and 261.

[26] *The Liverpool and Manchester Photographic Journal,* 1857, p. 231.

[27] *The Photographic Journal,* 15 Mar. 1862, p. 4.

[28] *The Photographic News,* 1866, p. 493.

[29] *The Photographic Journal,* 16 Nov. 1867, p. 135.

[30] Some modifications were described by de Camarsac in *Cosmos,* 1859, and reprinted in *The Liverpool and Manchester Photographic Journal,* 15 Aug. 1859.

[31] *The Liverpool and Manchester Photographic Journal,* 1857, p. 69, and 1858, p. 304.

[32] *La Lumière,* 6 Mar. 1858, and *The Liverpool and Manchester Photographic Journal,* 1 May 1858.

Part V THE GELATINE PERIOD

29 Emulsion papers and mass-production printing

[1] *The Photographic News,* 18 Nov. 1864.

[2] *The British Journal Photographic Almanac for the year 1888,* advertisement, p. 674.

[3] *The Photographic Journal,* 19 May 1882, p. 155.

[4] In America the name Aristotype was given indiscriminately to a variety of printing-out papers, both collodio-chloride and gelatine-chloride.

[5] *The British Journal of Photography,* 6 Mar. 1885, p. 150.

[6] The commercial introduction was due to a Mr Satchfield whose first advertisement appeared in *The British Journal of Photography,* 20 Mar. 1885.

[7] *The Times,* 24 Nov. 1884.

[8] *The British Journal of Photography,* 16 Oct. 1885, p. 668.

[9] *The Liverpool Photographic Journal,* vol. i, 1854, p. 44.

[10] 'Photography as an occupation for Women', *The British Journal of Photography,* 27 July 1900, p. 473.

[11] *The British Journal of Photography,* 9 May 1873, p. 223.

[12] Named after their places of manufacture, both small towns, in Southern France and Thuringia respectively.

[13] Leading makers were Steinbach & Co. in Malmédy and the Dresden Albumenising Co. mentioned in Chapter 16, which used Rive paper made by Blanchet Frères & Kleber.

[14] *The Photogram,* 1895, p. 236.

[15] Helmut Gernsheim, 'Valentine's of Dundee', *Functional Photography,* London, Oct. 1952.

30 Photography on film

[1] *The British Journal of Photography,* 25 June 1875, p. 307.

[2] *The British Journal of Photography,* 18 Sept. 1885, p. 602.

[3] *Journal of the Franklin Institute,* Philadelphia, 1888, p. 478.

[4] Carbutt's first English advertisement appeared in *The British Journal Photographic Almanac for the year 1889,* p. 845.

[5] Robert Taft, *Photography and the American Scene,* New York, 1938, p. 401.

[6] In 1902 the Eastman Kodak Company were producing 80 to 90 per cent. of all roll-films.

31 Hand, pocket, and detective cameras

[1] *The Liverpool Photographic Journal,* 1854, p. 118.

[2] *The Photographic News,* 11 May 1860.

[3] The first monorail camera was designed by Petzval in 1857.

[4] In 1894 Eastman paid S. N. Turner of the Boston Camera Co. 40,000 dollars for the patent rights of his 'invention' of the red window and the daylight film spool. Combined, these two inventions form the modern daylight roll-film system, but neither had its origin with the patentee.

[5] 'Kodak' was a purely arbitrary combination of letters, chosen by Eastman because it was short and vigorous, and not reminiscent of anything else in photography.

[6] Several larger models were introduced in the following years, with capacities ranging up to 250 exposures.

[7] The sales of Kodaks rose rapidly. In 1889 12,000 were in use; in 1890, 50,000; and by 1891, 90,000.

[8] *The Photographic Journal,* 21 Nov. 1856, p. 167.

[9] Op. cit., 15 May 1861, p. 187.

[10] Op. cit., 15 Apr. 1862, p. 26.

[11] Edwards also published a full description of it in *The British Journal Photographic Almanac for the year 1882,* p. 176.

[12] 'Photomechanical investigations', *Journal of Chemical Industry,* London, May 1890.

32 Push-button photography

[1] *The British Journal of Photography,* 18 Sept. 1885, p. 602.

[2] *Journal of the Society of Arts,* 26 Mar. 1886, p. 477.

[3] A selection of Zola's photographs was published in *Photo-Monde,* Paris, Oct. 1952.

[4] *Bulletin de la Société Française de Photographie,* 1892, p. 599.

[5] *The British Journal of Photography,* 7 June 1901.

[6] Op. cit., 8 Jan. 1892, p. 21.

[7] *Daily Mail,* Aug. 1905.

[8] *Camera,* Lucerne, May 1951.

[9] *The National Geographic Magazine,* Sept. 1954.

33 Photography by artificial light

[1] An engraving of this daguerreotype was presented to readers of the *Westminster Review* in Sept. 1840.

[2] *The Photographic News,* 1886, p. 370.

[3] *The Athenaeum,* 5 June 1847, p. 602.

[4] *The Photographic News,* 24 May 1861, p. 251.

[5] *Phil. Trans. Roy. Soc.* 1859, pp. 789–926.

[6] *The Photographic Journal,* 15 Mar. 1864, p. 6.

[7] The portraits of Faraday, Roscoe, Brewster, and Talbot are reproduced in *Manchester and Photography* by J. G. Chapman, privately published, Manchester, 1934.

[8] Communication from Vernon L. Jackson, *The British Journal of Photography,* Dec. 1876, p. 611.

[9] *The Photographic Journal,* 15 Sept. 1865, p. 146.

[10] *The Photographic News,* 1866, p. 567.

[11] This refers to a convenient holder invented by an American, A. Grant, in 1865, in which a

coil of magnesium wire was unrolled by clockwork at the exact speed with which it burned.

[12] *The British Journal of Photography,* 2 Feb. 1883, p. 61.

[13] Anthony Gerronnan, 'La photographie sous-marine', *Paris-Photographe,* vol. iii (1893), pp. 347-352; also Louis Boutan, *La photographie sous-marine,* Paris, 1900, chap. xii.

[14] *Image,* vol. v, no. 5, May 1956.

[15] J. M. Eder states that Aubrée, Millet, and Leborgne in 1851 inaugurated portraiture by a carbon arc light powered by 50 Bunsen galvanic elements, but the *Comptes Rendus* which he cites only mentions the authors' suggestion of the application of this light to photographing works of art and architectural details in dark churches.

[16] *Nature,* 18 Jan. 1883, p. 276.

[17] Nadar, *Quand j'étais photographe,* Paris, n.d. [1899], p. 114.

[18] Dr A. Wynter, *Peeps into the Human Hive,* London, 1874, vol. i, p. 61.

[19] *Journal of the Society of Arts,* 24 Feb. 1882, p. 370.

[20] H. Baden Pritchard, *The Studios of Europe,* 2nd ed., London, 1883, p. 284.

[21] J. W. Swan, *The Year-Book of Photography for the year 1881,* p. 122.

[22] *The British Journal of Photography,* 1878, p. 553, and advertisement in *The British Journal Photographic Almanac for the year 1880.*

34 The photography of movement

[1] Helmut Gernsheim, *Masterpieces of Victorian Photography,* London 1951; also *Creative Photography: Aesthetic Trends 1839–1960,* London and Boston, 1962.

[2] Karl Raupp, 'Die Photographie in der modernen Kunst', *Kunst für Alle,* 1889, p. 325.

[3] Information contained in a letter to the authors.

[4] *The Photographic Journal,* 17 Dec. 1867, p. 160. By mistake Pollock used the name 'chromatrope' instead of 'phenakistiscope' or 'stroboscope'.

[5] *Bulletin de la Société Française de Photographie,* 1876, p. 105.

[6] By a curious coincidence Marey's book *Animal Mechanism, a Treatise on Terrestrial and Aerial Locomotion* appeared in the same year, 1873, in which the anatomist Dr James Bell Pettigrew, F.R.S., of St Andrews University published his researches in *Animal Locomotion,* a work which also included a dissertation on aeronautics.

[7] Edward J. Muggeridge, son of a cornchandler at Kingston-on-Thames, had changed his name to what he considered to be its Anglo-Saxon original.

[8] J. D. B. Stillman, *The Horse in Motion, as shown by instantaneous photography. Executed and published under the auspices of Leland Stanford,* Boston, 1882.

[9] *The Photographic News,* 18 May 1860, p. 33.

[10] Talcott Williams, *The Century Magazine,* 1887, p. 359.

[11] *The Camera,* London, 1 Oct. 1888, p. 105, and *Photography,* London, 31 Jan. 1889, p. 137.

[12] However, as early as 1 Feb. 1859 George Shadbolt, editor of *The Liverpool and Manchester Photographic Journal,* had stated: 'Photography has dispelled the illusion of the old conventional way of rendering the horse at full gallop, having all four legs radiating from the trunk as from a centre–an attitude never in reality assumed by this animal.' Unfortunately Shadbolt does not mention any photographer's name in this connexion, but it may be Camille Silvy, who in Nov. 1860 presented some cartes-de-visite of horses in motion to the Société Française de Photographie.

[13] J. Plateau, 'Sur la persistance des impressions de la rétine', in supplement to Herschel's *Traité de la Lumière* vol. ii, Paris, 1833, p. 489.

[14] P. M. Roget, *Animal and Vegetable Physiology,* London, 1843, vol. ii, p. 524.

[15] *The British Journal of Photography,* 4 July 1879, p. 314.

[16] E. Muybridge, *Animal Locomotion*–Prospectus and catalogue of plates, Philadelphia, 1887, p. 7.

[17] A complete set of the eleven volumes, auctioned at Christie's, London, on 17 Mar. 1954, fetched £175. In 1960 another complete set, the Duke of Portland's, was offered in London for £425.

[18] Fifteen of Muybridge's copy negatives were presented by Charles A. Wilson to the Gernsheim Collection, which also possesses 200 plates of the Philadelphia publication. A large number of Muybridge's original negatives are preserved at George Eastman House, Rochester, N.Y.

[19] The first suggestion of a gun camera for taking instantaneous photographs was made by Thomas Sutton in *Photographic Notes,* 1 Aug. 1859.

[20] *Bulletin de la Société Française de Photographie,* May 1882.

[21] E. J. Marey, *Le Vol des oiseaux,* Paris, 1890.

[22] *Comptes Rendus de l'Académie des Sciences,* 7 Aug. 1882.

[23] E. J. Marey, *La Chronophotographie,* Paris, 1899, p. 26.

[24] Id., *Bulletin de la Société Française de Photographie,* 5 Feb. 1897.

[25] Though chronophotography undoubtedly paved the way for cinematography, this designation may with better justification be reserved for G. Brunel's *La Photographie et la Projection de Mouvement,* and L. Gastine's *La Chronophotographie sur plaque fixe et sur pellicule mobile,* both published in Paris in 1897, and C. M. Hepworth's *Animated Photography: the A.B.C. of the Cinematograph,* London, 1897.

[26] Reproductions of a number of Anschütz's photographs are contained in Arthur Morrison's article 'Instantaneous Photography' in the *Strand Magazine,* 1892, p. 629.

[27] It was also exhibited at the Crystal Palace, Sydenham, as 'the Electrical Wonder, combining the latest development in instantaneous photography with electrical automatic action.' The performances were continuous from 10 a.m. to 10 p.m.

[28] Dr Hugh Welch Diamond, Superintendent of the Surrey Lunatic Asylum at Twickenham, was probably the first worker in this field. His portraits, which were considered 'as perfect as Hogarth's studies of maniacs' were privately issued in 1854 under the title *Physiognomy of Insanity* and were for many years the horror of photographic exhibitions.

[29] Sir Charles Wheatstone, 'An account of some experiments to measure the velocity of electricity and the duration of electric light', *Phil. Trans. Roy. Soc.* 1834.

[30] *The Athenaeum,* 6 Dec. 1851.

[31] Mach and Salcher, 'Photographische Fixierung der durch Projektile in der Luft eingeleiteten Vorgänge'. Imperial Academy of Science, Vienna, vol. xcv, Apr. 1887, and 1889, p. 41.

[32] C. V. Boys, 'Photography of Flying Bullets', *Photographic Journal,* 30 Apr. 1892.

[33] William G. FitzGerald, 'Some Curiosities of Modern Photography', *The Strand Magazine,* 1895, p. 56.

[34] Lullin's work is illustrated in *The Photogram,* London, Apr. 1897.

[35] *Nature,* 16 July 1891. Three years later the photographic and electrical arrangements were described by Rayleigh's technical assistant R. S. Cole in *Nature,* 5 July 1894.

[36] A. M. Worthington, *The Splash of a Drop,* London, 1895; and *A Study of Splashes,* London, 1908.

[37] Lucien Bull, 'L'application de l'étincelle électrique à la chronophotographie des mouvements rapides', *Comptes Rendus de l'Académie des Sciences,* 1904; and *Travaux de l'Association de l'Institut Marey,* vol. ii, Paris, 1910, p. 51.

35 Documentation

[1] Jacob A. Riis, *How the Other Half Lives,* New York, 1890; and *Children of the Poor,* New York, 1892.

[2] Riis's photographs are preserved at the Museum of the City of New York.

[3] Arnold Genthe, *Old Chinatown. A Book of (91) Pictures with text by Will Irwin,* New York, 1913.

[4] Paul Martin's negatives and a large number of his prints are in the Gernsheim Collection.

[5] Paul Martin, 'London by Gaslight', *The Photogram,* Sept. 1898, p. 275.

[6] T. C. Hepworth, *Evening Work for Amateur Photographers,* London, 1890, chap. v.

[7] *Living London: Its Work and Its Play, Its Humour and Its Pathos, Its Sights and Its Scenes,* ed. George R. Sims, 3 vols, London, 1902–3.

[8] *Boyhood Photos of J. H. Lartigue,* Paris and New York, 1966.

[9] *Sir Benjamin Stone's Pictures: Records of National Life and History,* London, n.d. [1905], 2 vols.

[10] *Atget, Photographe de Paris,* with introduction by P. MacOrlan, Paris, 1930; *Atget,* with introduction by Camille Recht, Leipzig, 1930.

[11] MacOrlan and Recht, op. cit.; Berenice Abbott, *Eugène Atget,* Prague, 1963; A. D. Trottenberg, *A Vision of Paris: the Photographs of Eugène Atget, the Words of Marcel Proust,* New York, 1963.

36 Press photography

[1] Paul Martin, *Victorian Snapshots,* London, 1939, p. 34.
[2] 'A great Paris Photographer. M. Paul Nadar', by 'Ignota', *The Woman at Home,* vol. vi, Oct. 1898–Mar. 1899, pp. 151–156.
[3] *Bulletin de la Société Française de Photographie,* Feb. 1887, p. 46.
[4] W. B. Northrop, *With Pen and Camera: Interviews with Celebrities,* London, 1904.
[5] *The Photogram,* Nov. 1903, p. 352.

37 Naturalistic photography

[1] P. H. Emerson, *Pictures from Life in Field and Fen,* London, 1887, p. 11.
[2] *The Photographic Journal,* 16 Nov. 1866, p. 141.
[3] Op. cit., Mar. 1853, p. 6.
[4] E. W. Dallas, *The Photographic Journal,* 21 Apr. 1853, p. 44.
[5] Helmut Gernsheim, *Julia Margaret Cameron,* 2nd ed., New York, 1969
[6] Reprinted in *The British Journal of Photography,* 26 Dec. 1890, p. 821.
[7] *The Photographic News,* 3 Oct. 1890, p. 759.

38 The aesthetic movement

[1] Karl Voll, *Münchner Allgemeine Zeitung,* 1 Dec. 1898.
[2] G. Bernard Shaw, 'The Unmechanicalness of Photography', *The Amateur Photographer,* 9 Oct. 1902.
[3] G. Bernard Shaw, *The Amateur Photographer,* 11 Oct. 1901.
[4] Ibid.
[5] Ernst W. Juhl, *Das Lichtbild als Kunstwerk,* Halle, 1897; *Internationale Kunstphotographie,* Halle, 1900 and 1901; *Camera-Kunst,* Berlin, 1903.
[6] Alfred Lichtwark, foreword to *Künstlerische Photographie: Entwicklung und Einfluss in Deutschland* by F. Matthies-Masuren, Berlin, 1897.
[7] *Die Bildmässige Photographie,* 1904–6; *Photographisches Zentralblatt,* 1895–*c.* 1910, a monthly; *Die Photographische Kunst,* 1902–12, an annual.
[8] Paul L. Anderson, 'Some Pictorial History', *American Photography,* Boston, vol. ix, no. 4, Apr. 1935.
[9] Helmut Gernsheim, *Creative Photography; Aesthetic Trends 1839–1960,* London and Boston, 1962.

Part VI SOME APPLICATIONS OF PHOTOGRAPHY

39 Aerial photography

[1] This is the date given by Nadar in his magazine *L'Aéronaute,* Oct. 1863. In *Quand j'étais photographe* (1899) he erroneously claimed 1855 as the date.
[2] Hatton Turnor, in *Astra Castra,* London, 1865, illustrates 'Le Géant' on p. 257.
[3] The negative is in the Collection of the American Museum of Photography, Philadelphia.
[4] A. Batut, *La Photographie Aérienne par Cerf-volant,* Paris, *c.* 1890.
[5] Squadron Leader J. E. Bellingham, 'From Kites to Jets', Ilford *Visual,* vol. iii, no. 3, 1965.
[6] *Scientific American,* Dec. 1888.
[7] *The Illustrated London News,* 7 Dec. 1912. The photographs are reprinted in *Image,* June 1960, with an article by Beaumont Newhall.

40 *Under-water photography*

[1] Reprinted, with additions, from the authors' article in *Photography*, London, Mar. 1957.
[2] Louis Marie Auguste Boutan, *La Photographie sous-marine et les Progrès de la Photographie*, Paris, 1900.

41 *Photography of criminals*

[1] Reprinted, with additions, from the authors' article in *Photography*, London, Feb. 1957.

42 *Medical photography*

[1] Alison Gernsheim, 'Medical Photography in the Nineteenth Century', *Medical and Biological Illustration*, London, Part I (Apr.), Part II (July) 1961. Various sections of the paper were reprinted in medical journals in many other countries.

Part VII THE EVOLUTION OF COLOUR PHOTOGRAPHY

43 *The evolution of colour photography*

[1] *Photographic Notes*, June 1861.
[2] *The British Journal of Photography*, vol. ix, 1865, p. 547.
[3] Alcide Ducos du Hauron, *La Triplice Photographique des Couleurs et l'Imprimerie*, Paris, 1897.
[4] Charles Cros, *Solution Générale du Problème de la Photographie des Couleurs*, Paris, 1869.
[5] L. Ducos du Hauron, *L'Héliochromie*, Agen, 9 Apr. 1874.
[6] Sir John Herschel, *Phil. Trans. Roy. Soc.*, 1840, p. 28.
[7] Edmond Becquerel, 'La Production des Couleurs sous l'action de la Lumière', *Comptes Rendus*, Dec. 1857. See also Becquerel's general treatise, *La Lumière, ses causes et ses effets*, 2 vols., Paris, 1867–68.
[8] His experiments are recorded in *Comptes Rendus*, 1851, 1852, 1862, 1863 and 1866.
[9] *Comptes Rendus*, 1865, p. 1111.
[10] Gabriel Lippmann, *Comptes Rendus*, 1891, p. 274; and *The Photographic Journal*, 1897.

Part VIII PHOTOGRAPHY AND THE PRINTED PAGE

44 *Photomechanical printing processes*

[1] Georg Kessler, *Photographie auf Stahl, Kupfer und Stein zur Anfertigung von Druckplatten für den Kupfer-, Stein- und Buchdruck*, Berlin, 1856.
[2] *Comptes Rendus*, 15 June 1840. Published in full in *Le Technologiste*, vol. i, Aug. 1840, p. 527.
[3] Reprinted verbatim in *The Magazine of Science*, 6 June 1840, p. 78.
[4] In the *Proceedings of the London Electrical Society 1841–3*, London, 1843, p. 257, it is stated, probably erroneously, that 500 impressions could be made.
[5] *Comptes Rendus*, 1 Mar. 1841, p. 401.
[6] *Excursions daguérriennes* was probably published in an edition of 2,000 or more.
[7] *Proceedings of the London Electrical Society 1841–3*, London, 1843, p. 94.
[8] *The Photogram*, 1900, p. 224.
[9] *The Athenaeum*, 30 Apr. 1853. Reprinted in *The Photographic Journal*, 21 May 1853.
[10] Ibid.
[11] *Comptes Rendus de l'Académie des Sciences*, 23 May 1853. Reprinted in *The Photographic Journal*, 21 Sept. 1853.
[12] *The Photographic Journal*, 16 Jan. 1864.
[13] *Photographic Notes*, 15 Nov. 1856, p. 236.
[14] Ibid.
[15] *The Photographic News*, 9 Sept. 1859.

[16] A complete set of choice proofs is in the Gernsheim Collection.

[17] *The [Liverpool & Manchester] Photographic Journal,* 1 Feb. 1859.

[18] Op. cit., 15 Mar. 1857, p. 64.

[19] Op. cit., 1 Feb. 1859.

[20] Jabez Hogg, *The Microscope: its History, Construction, and Applications,* London, 1854.

[21] *The Photographic News,* 31 July 1863, p. 363.

[22] J. M. Eder, *History of Photography,* English edition, New York, 1945, p. 583.

[23] Charles Nègre, *De la Gravure héliographique, son utilité, son origine, son application,* Nice, 1867.

[24] Otto M. Lilieu, *History of Industrial Gravure Printing up to 1900,* London, 1957.

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CONCLUSION

[1] For a detailed plan concerning the functions of such an institute, see *The Times,* 3 March and 31 May 1952; and our papers to the International Conference on the Science and Applications of Photography, London, September 1953, and to the Rencontres Internationales sur le Rôle de l'Image dans la Civilisation Contemporaine, held at UNESCO, Paris, May 1955.

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Appendix

EXPOSURE TIMES

The table gives the average exposure time in bright weather. It varied greatly with the season, subject, and negative size, exposures with large cameras requiring long focal lenses being several times as long compared with small sizes and short focal lenses. The diaphragm used is assumed to be the same in all cases.

Process		*Date of introduction*	*Average exposure* *hrs*	*min*	*sec*
Heliography	printing plate	1822	2–3		
	camera photograph from nature	1826	8		
Daguerreotype	half-plate and whole-plate sizes	1839		15–30	
	chemical acceleration and very small sizes	1841			20–90
	ditto, combined with better lenses	1842			10–60
Photogenic drawing	in camera	1839		30–60	
Calotype	portraits, up to half-plate	1841		1–2	
	landscapes, larger sizes	1841		3–7	
Waxed paper	landscapes	1851		3–7	
Albumen-on-glass		1848		6–18	
Wet collodion	large landscapes	1851			30–120
	Stereoscopic, indoor	1851			5–20
	Stereoscopic, outdoor	1854			$\frac{1}{2}$–5
	Ambrotypes, up to 5× 4 in.	1851			2–20
	Studio portraits, half-plate to 10× 8 in. size, for larger plates increasingly longer	1851			40–120
'Dry' (preservative) collodion	only used for outdoor work	1854		2–10	
Collodion emulsion		1864			1–60
Gelatine emulsion		1878			$\frac{1}{25}$–4
Gelatine emulsion		1900			$\frac{1}{250}$–1

APPROXIMATE PERIODS OF PHOTOGRAPHIC PROCESSES INVENTED BEFORE 1914

Process	*Invented by*	*In general use*
Heliography: printing plate	Niépce, 1822	—
„ 1st photograph	Niépce, 1826	—
Daguerreotype	Daguerre, 1837	1839–*c.* 1857

Process	*Invented by*	*In general use*
Photogenic drawing	Talbot, 1835	1839–1841
Calotype	Talbot, 1840	1841–*c.* 1857
Albumen-on-glass	Niépce de Saint-Victor, 1847	1848–*c.* 1857
Waxed paper	Gustave Le Gray, 1851	1851–*c.* 1857
Wet collodion	Archer, 1850	1851–*c.* 1880
Ambrotype	Archer & Fry, 1851	1852–*c.* 1863
'Dry' (preserved) collodion	Numerous processes	1854–*c.* 1870
Collodion emulsion	Sayce & Bolton, 1864	1864–*c.* 1880
Gelatine emulsion	Maddox, 1871 Improved by: Burgess, 1873 Kennett, 1873 Bennett, 1878	1878–present day
Celluloid cut film	Carbutt, 1888	1889–present day
Nitrocellulose roll-film	Goodwin, 1887 Reichenbach & Eastman, 1889	1889–present day
Positive printing papers:		
Plain salted (silver chloride)	Talbot, 1835	1839–*c.* 1857
Albumen	Blanquart-Evrard, 1850	1850–*c.* 1895
Collodio-chloride	Simpson, 1864	1865–*c.* 1895
Carbon	Swan, 1864	1866–*c.* 1930
Platinotype	Willis, 1873 and 1878	1880–*c.* 1914
Gelatine bromide	Mawdsley, 1873 Swan, 1879	1880–present day
Gelatine chloride	Eder & Pizzighelli, 1881	1882–present day
Gelatine chloride P.O.P.	Abney, 1882 Barker, 1885	1886–present day
Chloro-bromide	Eder, 1883	1884–present day
Gum prints	A. Rouillé-Ladêveze, 1894 Demachy, 1895	1895–*c.* 1930
Ozotype	Thos. Manly, 1899	1899–*c.* 1914
Oil process	G. E. H. Rawlins, 1904	1904–*c.* 1930
Ozobrome process	Thos. Manly, 1905	1905–*c.* 1930
Bromoil process	C. Welborne Piper, 1907 E. J. Wall, 1907	1907–*c.* 1930
Carte-de-visite	Disdéri, 1854	1859–1914
Cabinet views	G. W. Wilson, 1862	1862–*c.* 1900
Cabinet portraits	Window, 1866	1866–*c.* 1914
Photographic postcards	(Germany)	1884–present day
	Rotary Photographic Co. (England)	1901–present day

MILESTONES IN PHOTOGRAPHIC OPTICS

First achromatic portrait lens specially designed for photography by Joseph Petzval, Vienna, introduced by Friedrich Voigtländer, Vienna	Jan. 1841
First aplanatic lens designed and introduced by Thomas Grubb, Dublin	Oct. 1857
Improved aplanat designed and introduced by Adolph Steinheil, Munich	1866
Rapid Rectilinear lens, also an aplanat, introduced by John Henry Dallmeyer, London	1866

First anastigmat, the 'Protar' (F. 7·5), designed by Paul Rudolph, introduced by Carl Zeiss, Jena	1889
First telephoto lenses introduced independently by A. Steinheil and Thomas Ross Dallmeyer, London	1891
First double anastigmat, 'Dagor' (F. 6·8), designed by Emil von Hoegh, introduced by Carl Paul Goerz, Berlin	1893
Cooke triplet (F. 3) introduced by Harold Dennis Taylor, London	1893
First good wide-angle lens, the 'Hypergon' (F. 14), a double anastigmat designed by E. von Hoegh, introduced by C. P. Goerz	1900
The 'Tessar' (F. 4·5), lens, an anastigmat designed by Paul Rudolph, introduced by Carl Zeiss	1902

THE FIRST DECADE OF PHOTOGRAPHIC SOCIETIES

Society and first president where known	*Established*	*Discontinued*
Société Héliographique, Paris (Baron Gros)	Feb. 1851	1854
The Daguerrean Association of New York	1851	?
Leeds Photographic Society (Samuel Smith)	Apr. 1852	*c.* 1860
Photographic Society of London (Sir Charles Eastlake, P.R.A., F.R.S.)	Jan. 1853	Unbroken record to date
Liverpool Photographic Society (the Mayor of Liverpool)	Mar. 1853	Merged with Historic Society of Lancashire and Cheshire, Feb. 1858
Devon & Cornwall Photographic Society (Capt. R. E. Scott)	Jan. 1854	Before 1859
Glasgow Photographic Society	Mar. 1854	*c.* 1859
Norwich Photographic Society (T. D. Eaton)	June 1854	1861
Dublin Photographic Society (Lord Otho Fitzgerald)	Nov. 1854	Became Photographic Society of Ireland, May 1858. Re-established in 1879
Société Française de Photographie, Paris (Eugène Durieu)	Nov. 1854	Unbroken record to date
Photographic Society of Bombay (Harry Barr)	Oct. 1854	?
Brighton & Sussex Photographic Society	June 1855	Before 1859
Manchester Photographic Society (the Bishop of Manchester)	Nov. 1855	Unbroken record to date
Photographic Society of Scotland (Sir David Brewster, F.R.S.)	Apr. 1856	June 1867
Dumfries & Galloway Photographic Society (P. Dudgeon)	May 1856	*c.* 1859
Société Photographique de Boulogne (E. de Poilly)	May 1856	?

Society and first president where known	*Established*	*Discontinued*
Birmingham Photographic Society (Prof. George Shaw)	Oct. 1856	1866
Photographic Society of Bengal	1856	?
North London Photographic Association (Charles Woodward, F.R.S.)	Mar. 1857	Dec. 1869
Photographic Society of Belfast	May 1857	?
Chorlton Photographic Association (Prof. Frankland, F.R.S.)	June 1857	*c.* 1865
Blackheath Photographic Society (James Glaisher, F.R.S.)	June 1857	1863
Greenwich Photographic Society	1857	*c.* 1865
Paisley Photographic Society	1857	*c.* 1859
Nottingham Photographic Society (Duke of Newcastle)	Jan. 1858	?
Photographic Society of South Russia (at Odessa) (Count Michael Tolstoy)	Jan. or Feb. 1858	?
Macclesfield Photographic Society	Apr. 1858	*c.* 1865
American Photographic Society, New York (Prof. John William Draper)	Feb. 1859	?
South London Photographic Society (Rev. F. F. Statham)	May 1859	1887
Allgemeiner Deutscher Photographen-Verein, Jena (Dr Julius Schnauss)	1859	?
City of Glasgow & West of Scotland Photographic Association (John Kibble)	Feb. 1860	1902
Société Photographique de Marseille	June 1860	?
Bradford Photographic Society (W. H. Leather)	Nov. 1860	?
Edinburgh Photographic Society (J. D. Marwick)	Feb. 1861	Unbroken record to date
Newcastle-on-Tyne Photographic Society (J. E. Headlam, M.P.)	Feb. 1861	?
Photographische Gesellschaft, Vienna (A. Martin)	1861	Unbroken record to date
Amateur Photographic Association, London (the Prince of Wales)	Sept. 1861	1905

As will be seen, most of the early photographic societies, which were founded in the first flush of enthusiasm following the introduction of the collodion process, and the setting free of photography from patent restrictions in England, became extinct when the novelty had worn off, and wet plate photography proved too laborious. The general introduction of the ready-made gelatine dry plate and hand cameras gave a new impetus to amateur photography and new societies were formed, and some old ones re-established (see Chapter 32).

THE FIRST DECADE OF PHOTOGRAPHIC JOURNALS

Le Daguerréotype, revue de la photographie was intended to be published every three months by Mayer Frères, Paris, but was discontinued after one issue in June 1847.

Photographic journals therefore begin with

1 *The Daguerreian Journal devoted to the Daguerreian and Photogenic Art*, a fortnightly journal edited and published by S. D. Humphrey of New York, first appeared on 1 Nov. 1850. It continued as *Humphrey's Journal of Photography* until July 1870, but publication was suspended between Jan. and 15 April 1852.

2 *The Photographic Art Journal*, a monthly journal edited by H. H. Snelling of New York, appeared first in Jan. 1851. In 1854 the title was changed to *The Photographic and Fine Art Journal*, illustrated with original photographs. In 1861 it combined with *The American Journal of Photography* (see No. 4).

3 *La Lumière* founded in Paris by Col. de Montfort and Abbé Moigno and edited from its first issue on 9 Feb. 1851 until 15 Dec. by F. A. Renard. With the beginning of the second vol. on 16 Nov. 1851 there was a change of ownership; the new proprietor Alexis Gaudin discontinued the paper's connection with the Société Héliographique. With the issue of 15 Dec. 1851 Ernest Lacan assumed editorship, and from 30 Jan. 1852 onward the journal was published weekly: until then, publication was irregular, sometimes weekly, sometimes fortnightly. At the end of Dec. 1860 Lacan resigned the editorship and founded his own paper (see No. 26). He was succeeded by the proprietor's elder brother Marc Antoine Gaudin. A total of 12 vols. appeared between Feb. 1851 and Dec. 1860. Last issue 30 Dec. 1866.

4 *The American Journal of Photography*, edited by Charles A. Seely. A monthly founded in 1852. From 1859 on a fortnightly. Last issue September 1867, when it was combined with *Humphrey's Journal of Photography* which ceased publication in 1870 (see No. 1).

5 *The Journal of the Photographic Society of London*, a monthly magazine from its first issue on 3 March 1853. In Jan. 1859 changed its title to *The Photographic Journal*. The oldest photographic journal in the world with an unbroken record, though at some periods, i.e. 1870–93 and again 1912–1918, only 8 or 9 issues were published annually. First editor Arthur Henfrey, F.R.S., from Jan. 1856–June 1857 the Rev. J. R. Major, until Aug. 1858 William Crookes, until Dec. 1868 Dr Hugh W. Diamond, until Feb. 1880 John Spiller, thereafter Capt. W. de W. Abney.

6 *Le Propagateur*, artistic and commercial weekly paper specially devoted to photography. Edited by Guillot, Paris. Appeared between 20 Nov. 1853 and 24 July 1855.

7 *Photographisches Journal, Magazin für Photographen, Maler, Zeichner, und Freunde dieser Kunst*, edited by Wilhelm Horn and published in Leipzig fortnightly from 1 Jan. 1854 to 1865. The first photographic magazine in the German language.

8 *The Liverpool Photographic Journal*. Started 14 Jan. 1854. In Jan. 1857 changed its title to *The Liverpool & Manchester Photographic Journal* and in Jan. 1859 to *The Photographic Journal*. Since Jan. 1860 the title has been *The British Journal of Photography*, under which it still continues. Originally a monthly, from Jan. 1857 a fortnightly, and from Jan. 1865 a weekly. The first six editors were successively: Charles Corey; Frank Howard; G. R. Berry; William Crookes; T. A. Malone; and George Shadbolt.

9 *Bulletin de la Société Française de Photographie*. First issue 1 Jan. 1855. A monthly, and between 1892 and 1909 fortnightly; still continues, though there have been breaks in its continuity, such as during the Franco-Prussian War, Jan.–Jun. 1871. First editor A. Girard.

10 *Journal of the Photographic Society of Bombay*. A monthly started in Bombay, Jan. 1855–? First of several photographic journals published in English in India.

11 *Le Photographe: revue de la photographie française et étrangère*. Edited by A. Herling, Paris. Five issues, 1 Nov. 1855–1 Feb. 1856.

12 *Revue photographique*. A monthly magazine published in Paris. First issue 5 Nov. 1855, continued until Dec. 1865.

13 *Photographic Notes*, edited by Thomas Sutton and published first in Jersey, later in London. Appeared as a monthly between 1 Jan. 1856 and Aug. 1856, and fortnightly from Sept. 1856 to Dec. 1867.

14 *Le Spectateur, organe de la photographie, des arts, de la littérature et de l'industrie*. Edited by Auguste Caron, Paris. Only one issue, July 1856.

15 *The Photographic Record and Amateur's Guide*. Published fortnightly by John Rowland, London, between Oct.? 1856 and 1857.

16 *Photographisches Album*. A monthly magazine edited by Mathias Weingartshofer, published in Vienna between 1857 and 1859.

17 *Le Photographe*, edited by Édouard de la Treille, Paris. Six numbers published between 19 Nov. 1857 and 13 Mar. 1858.

18 *The Photographic News*, a weekly magazine published in London starting on 10 Sept. 1858 and edited by William Crookes until August 1860, and by George Wharton Simpson until his death on 14 Jan. 1880 when he was succeeded by Henry Baden Pritchard, after whose death on 11 May 1884 Thomas Bolas became editor. During the editorship of F. J. Mortimer the magazine was incorporated with *The Amateur Photographer* on 12 May 1908.

19 *The Art Review & Photographic Record*. Edinburgh. Published monthly for a short period, starting May 1858.

20 *The Photographic Art Journal*. Edited anonymously, published monthly by W. Lay in London between Feb. 1858 and Dec. 1858. Then republished as one volume under the title *The Photographic Art Annual*, London, 1859. Illustrated with original photographs.

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24 *Zeitschrift für Fotografie und Stereoskopie*: Organ der fotografischen Gesellschaft in Wien. A monthly edited by Dr K. Joseph Kreutzer, and published in Vienna between 1860 and 1864.

25 *The Photographic Quarterly Review*, edited by Thomas Sutton, London 1860. Only two issues published, the first on 1 Aug. 1860.

26 *Le Moniteur de la Photographie* appeared fortnightly from Jan. 1861 until 1914. Edited at first by Ernest Lacan and Paul E. Liesegang and published in Paris.

27 *Bulletin Belge de Photographie*. A monthly published in Brussels, 1861–?.

28 *The Photographic Times, a Chronicle of the Progress of the Photographic Art*. Published successively by John Rowland jun., Thomas Kingham, and John Clayton, London, as a fortnightly, from 1 Nov. 1861 to 15 Jan. 1865. No editor's name is given. After 1865 this title was adopted by the Scovill Manufacturing Co. of New York for their magazine.

Note. *The Dublin Photographic Journal*. First issue 1 Jan 1855. A monthly journal. No copy has been traced of this journal.

The Stereoscopic Magazine published monthly in London between 1 July 1858 and Feb. 1865 is *not* concerned with photography as subject-matter, though each number is illustrated with three stereoscopic photographs.

The Photographer (Nos. 1 and 2–the only ones published), n.d., 8 pp. each. Published by W. Roberts, Exeter. This is a religious tract: only one sentence seems to have a connexion with photography–'The light which falls on you is unsteady'–a sentiment with which photographers would not quarrel!

ANNUALS

The Photographic Almanac and Ready Reckoner for the Year of Our Lord 1859 (pub. 1858). Pub. by W. Lay, London. This, and vol. i of the next item, are the earliest photographic almanacs in the world. One volume only: it was incorporated in 1859 in–

The Photographic News Almanack, vols. i–v for 1859–63 (no publication dates–1858–62). Continued as *The Year Book of Photography and Photographic News Almanack for the Year 18..*, &c., vols. vi–xlvii, 1864–1907 (no publication dates). Usually it was compiled by the editor of *The Photographic News*.

The British Journal Photographic Almanack, 15 Dec. 1859 (for the year 1860) to the present day. It was first published as a wall calendar for the year 1860, and given away as a supplement to the above-mentioned issue of *The British Journal of Photography*, and could be bought by non-subscribers for 3*d*. The Almanac for 1861 was a tiny pocket-book 16mo size and contained besides the calendar a miscellany of photographic information such as meetings of societies, formulae, tables, &c., which were edited by Samuel Highley. The publication continues to the present-day 8vo size.

Acknowledgments

The majority of the photographs and other illustrations are reproduced from prints in the Gernsheim Collection at the Humanities Research Center of the University of Texas. The remaining illustrations were supplied by courtesy of the following: M. F. Braive, 198; Trustees of the British Museum, London, 5; the Californian Palace of the Legion of Honor, San Francisco, 261; Ronald Chapman, 193; Library of Congress, Washington, D.C., 147, 148, 172; E. J. Denny, 56; George Eastman House, Rochester, N.Y., 46-48, 190, 223, 224, 260, 266, 286; Hans Hammarskiöld Collection, Stockholm, 304; 'Illustration', 22; Collection André Jammes, Paris, 93; Staatliche Landesbildstelle, Hamburg, 64, 66; Museum für Hamburgische Geschichte, Hamburg, 63; Museum of the City of New York, 258; The Metropolitan Museum of Art, New York, 50, 177, 178 (David Hunter McAlpin Fund, 1947), 250 (Gift of Charles Bregler, 1947); Museum of Modern Art, New York, 251, 269; Mrs Barbara Peecock, 82; Paul Popper Ltd, 268; Radio Times Hulton Picture Library, 20; Royal Photographic Society Collection, London, 32, 37, 104, 108, 112, 288; Royal Scottish Museum, Edinburgh, 61, 67; Science Museum, London, 31, 33, 36, 38, 39, 95 (lent by the Royal Photographic Society); Professor Erich Stenger, 166, 167, 214; the late Professor Robert Taft, 49; Miss Mathilda Talbot and Harold White, 32, 78; the Walker Art Gallery, Liverpool, 26; Josiah Wedgwood & Sons Ltd, 16 (from the Harold White Collection); Collection Berthold Wolpe, 149

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